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NEW DIRECTIONS IN ENERGY
COLSTRIP I & II

A DISCUSSION OF OBJECTIVES, RESULTS ACHIEVED AND IMPLICATIONS FOR THE FUTURE

As presented to

THE MONTANA PUBLIC SERVICE COMMISSION

By

THE MONTANA POWER CO.

JUNE 21, 1978

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NEW DIRECTIONS IN ENERGY SERIES: Part 2 -- Colstrip 1 and 2

- PURPOSE: Conduct of meaningful dialog on important energy issues
- CONTENT: World, national, regional and Montana energy situation and outlook
- CENTRAL ISSUES
  - Energy and Society
  - Energy and our Economy
  - Energy and Environment
  - Energy and the Quality of Life
- TODAY'S DISCUSSION
  - A Major Montana Energy Source: Colstrip 1 and 2

- SEE APPENDIX A FOR J. A. MC ELWAIN'S INTRODUCTORY REMARKS

NEW DIRECTIONS IN ENERGY SERIES: Part 2 -- Colstrip 1 and 2

- COLSTRIP 1 and 2 IN PERSPECTIVE: The years of change 1968-1978
  - Colstrip's development 1968-1978 paralleled sweeping social, political and economic changes:
    - World
    - U.S.A.
    - Montana

- THE YEARS 1968-1975 ELEMENTS OF CHANGE - 1
  - U.S. and Montana environmental objectives, legislation established
  - New Montana Siting Act
  - Coal Severance Tax
  - Creation of new Montana Public Service Commission, Department of Natural Resources and Department of Health

- THE YEARS 1968-1975 ELEMENTS OF CHANGE - 2
  - Arab Oil Embargo
  - World, National, Regional Energy Crisis
  - Inflation, recession, unemployment
  - Major shift in Montana and Northwest from virtually all hydro to need for major thermal generation to meet social, economic, energy needs and to sustain the quality of life.

- SIGNIFICANCE OF THESE CHANGES FOR THE FUTURE
    - They have reshaped our times
    - They have reshaped our vision of the future
        - and what must be done to achieve it.
    - They call for new Directions in Energy Management
        - Conservation
        - Alternative Energy Opportunities
        - Planning
        - Regulation
    - And the need for
        - Vision
        - Statesmanlike, coordinated planning and action
            - Each playing appropriate role to achieve common objectives
        - Innovative solutions to difficult problems
    - Fresh approach to the future

NEW DIRECTIONS IN ENERGY SERIES: Part 2 -- Colstrip 1 and 2

- Overview - 1
  - Beginning of Colstrip
  - The Common Objective: Achieving clean air/clean water goals, safe, economical, reliable supply of energy for the future.
  - What has been achieved by the people of Montana:
    - Leading the nation in clean air/water goal attainment
      - Some problems in the past
      - Working toward more certainty in the future

- Overview - 2
  - Significance of Colstrip 1 and 2 for the Future
    - Proven ability of Montanans, working together to achieve the "then" (early 1970's) clean air goals.
    - The hope, confidence and objective is that prudent, reasoned balance in clean air/water, economy, and technology can assure future
      - Economic well being
      - Quality of life

      for the people of Montana.
    - Colstrip 1 and 2 become one important building block for the future.
  - Now, the discussion.

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COLSTRIP #1 AND #2

OBJECTIVES

- CONSUMER, PSC AND MPC HAVE SAME OBJECTIVES

- OUR STATEMENT OF THE OBJECTIVES
    - To Provide a Safe, Reliable Supply of Energy, at a Reasonable Cost, at a Reasonable Profit as Compatibly as Possible with the Environment

- MPC HAS WORKED AND WILL CONTINUE TO WORK TO MEET THESE OBJECTIVES
    - Importance of Conservation
        - Vital role of the consumer in conservation and participation in energy management programs
            - leads to reliable supply, minimum cost, assurance of future supply

OVERVIEW 1

- DISCUSS COLSTRIP AS IT EXISTS TODAY
  - Planning Design in 1968
- REVIEW THE HISTORY AND BACKGROUND OF COLSTRIP:
  - What were the Original Objectives and the Technical Clear Air Requirements?
  - How These Were Attained
  - The Evolution of the Technical Requirements
  - The Evolution of How These Were Met
- PROCEED THROUGH THE PROJECT DEVELOPMENT REVIEWING:
  - Major Events/Milestones Affecting Results
  - Key Technical Requirements
  - Decision Criteria
  - How Decisions Were Made
- DISCUSS THE COLSTRIP RESULTS:
  - Economics of Energy -- Attainment of Cost Objectives
  - Attainment of Environmental Objectives:
    - Clean Air
    - Clear Water
    - Minimum Waste Disposal

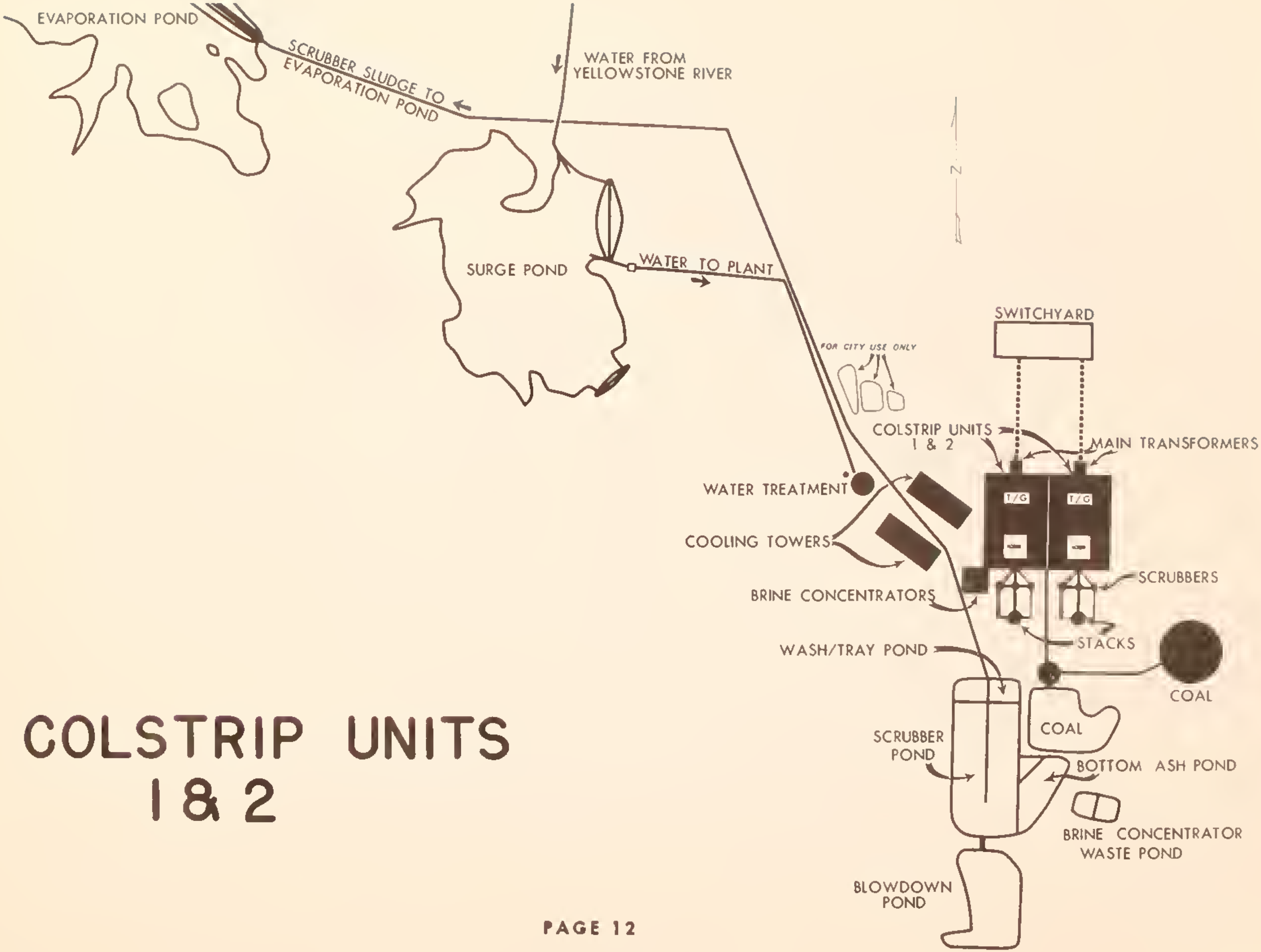
OVERVIEW 2

- WE WILL ENDEAVOR TO ANSWER SUCH QUESTIONS AS:
  - What are the Final Costs of Colstrip Compared to the Original Estimates?
  - What are the O&M Costs of Colstrip?
  - How Do They Compare with Other Roughly Comparable Plants?
  - How are the Plants Performing in Terms of On-Line Generation Time and Air Quality Performance?
  - What did the Scrubbers Cost Compared to the Original Estimates?
  - What were the Criteria for Selection of Scrubber Equipment and How was the Selection Determined?
  - How Much are We Spending for Scrubber O&M and How Does This Compare with Others?
  - How are the Scrubbers and Associated Equipment Performing in Terms of Air Quality, Cost Effectiveness and Plant Availability?
  - Have We Achieved the Clean Air Quality Standards?
  - Have We Achieved Them Economically?
- AND, ANSWER ANY ADDITIONAL QUESTIONS

COLSTRIP UNITS #1 AND #2

- PURPOSE OF COLSTRIP UNITS #1 AND #2: PROVIDE ECONOMICAL, ENVIRONMENTALLY COMPATIBLE COAL-FIRED ENERGY

- MAJOR COMPONENTS
  - Two Generating Stations With Net Generation Capacity of 330 MW Each
  - General Electric Turbine-Generator
  - Combustion Engineering Boiler
  - Combustion Equipment Associate Scrubbers
  - Resource Conservation Corporation Brine Concentrators for Water Treatment
  - Graver Clarifiers for Water Treatment
  - Ecodyne Cooling Towers for Cooling
  - Scrubber Ponds and Blowdown Ponds for Water Recycling
  - 150 Acre Surge Pond for Plant, Town and Recreational Use
  - Evaporation Pond for Final Ash Disposal and Evaporation of Water

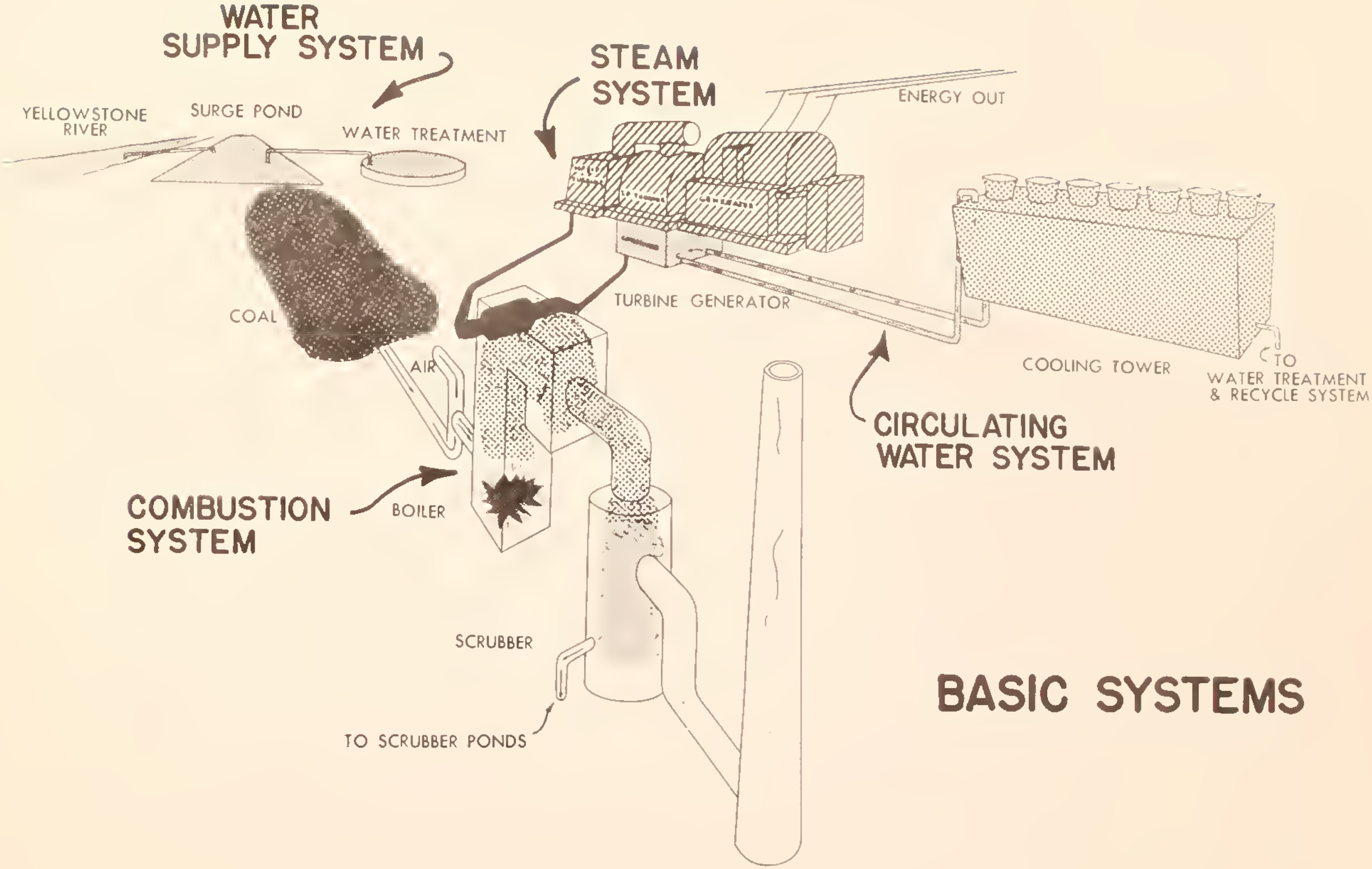


COLSTRIP UNITS
1 & 2

COLSTRIP FACILITY

- BASIC SYSTEMS
  - Water Transport/Holding/Treatment System
  - Combustion System
  - Steam System
  - Circulating Water System
  - Scrubber System

- SPECIAL AND UNIQUE FEATURES
  - Closed Loop Water System -- No Return to the River
  - Scrubber System Uses Alkaline Fly Ash -- Very Economical, High Performance
- RESULT: EPA FINDS COLSTRIP #1 AND #2 UNSURPASSED IN CLEAN AIR/WATER/WASTE DISPOSAL PERFORMANCE -- DECEMBER 1977

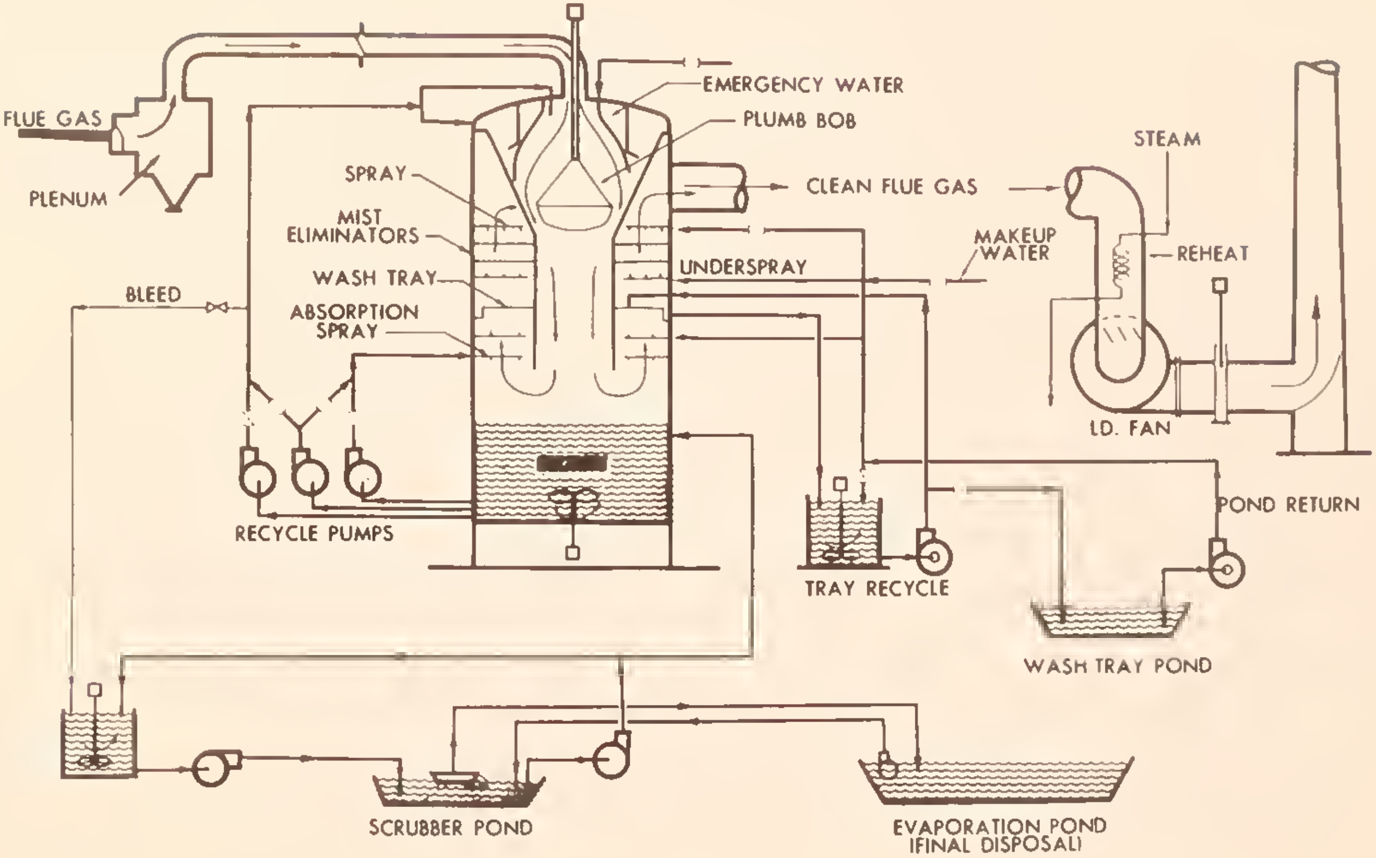


BASIC SYSTEMS

SCRUBBER SYSTEM

- THE PURPOSE OF THE SCRUBBER SYSTEM IS TO REMOVE:
    - Particulate
    - Sulfur Dioxide
- SCRUBBER SYSTEM INCLUDES
    - Scrubber Vessel
        - Tangential Nozzles
        - Plumb-Bob
        - Lower Sprays
        - Wash Trays
        - Mist Eliminators
        - Agitator
    - Reheater
    - ID Fan
    - Recycle System
        - Scrubber Ponds/Recycle Pumps
    - Wash Tray Recycle Systems
        - Wash Tray Pond/Recycle Pumps
    - Evaporation Pond
- RESULT: PRODUCES AIR QUALITY MUCH BETTER THAN REQUIRED STANDARDS
    - Particulate: Colstrip $\underline{.035\ \text{lb}/10^6\ \text{Btu}}$ --- Standard $\underline{.10\ \text{lb}/10^6\ \text{Btu}}$
    - SO_2: Colstrip $\underline{.28\ \text{lb}/10^6\ \text{Btu}}$ --- Standard $\underline{1.2\ \text{lb}/10^6\ \text{Btu}}$

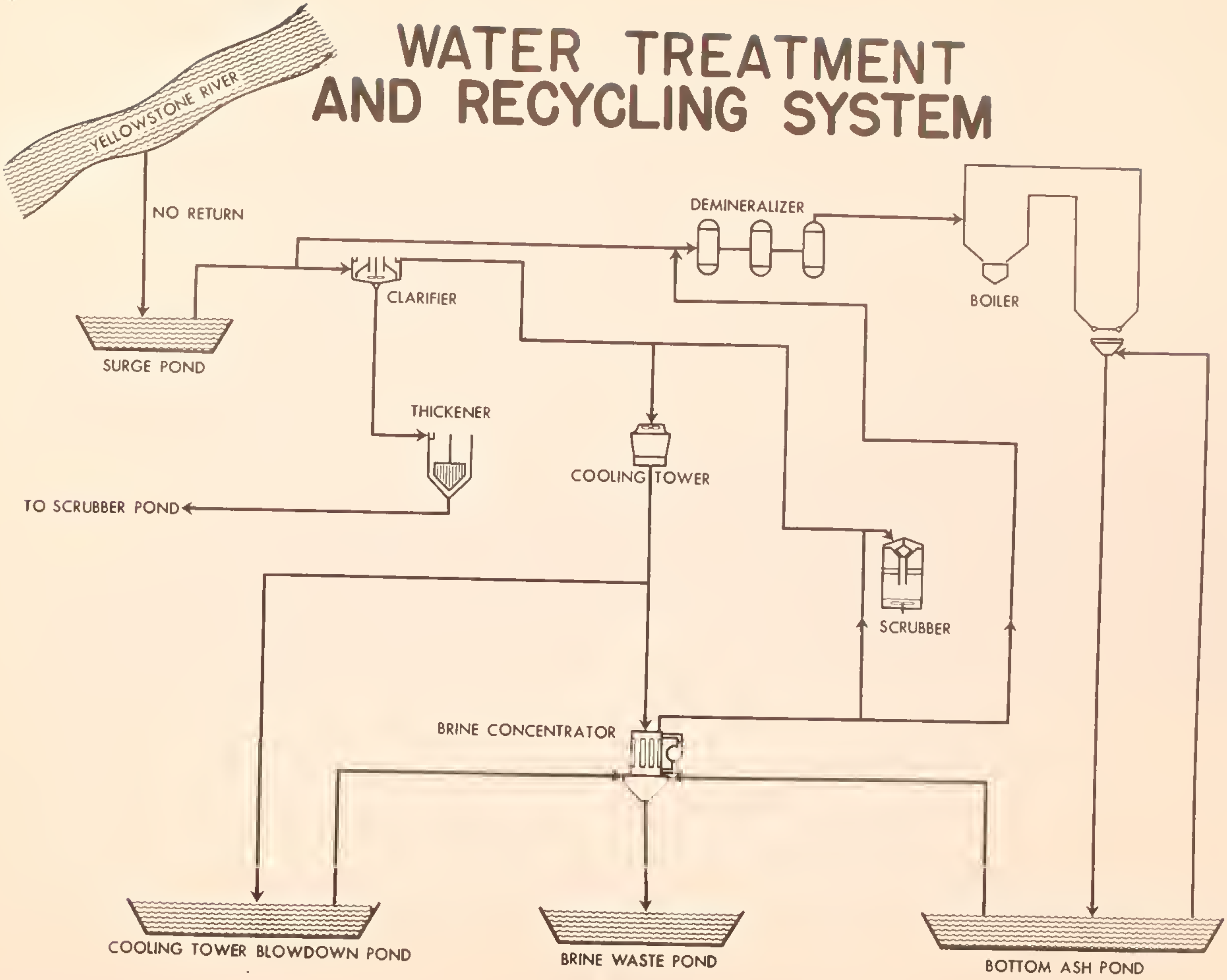
SCRUBBER SYSTEM



WATER TREATMENT AND RECYCLING

- PURPOSE
  - To Achieve a Closed Loop System
  - Eliminate Waste Water Return to the River
- INCLUDES:
  - Clarifier
  - Thickener
  - Demineralizer
  - Cooling Tower
  - Scrubber
  - Brine Concentrator
  - Blowdown Pond
  - Brine Waste Pond
  - Bottom Ash Pond
  - Scrubber Pond
- RESULT: NO EFFLUENT RETURNED TO THE RIVER OR WATER TABLE

WATER TREATMENT AND RECYCLING SYSTEM



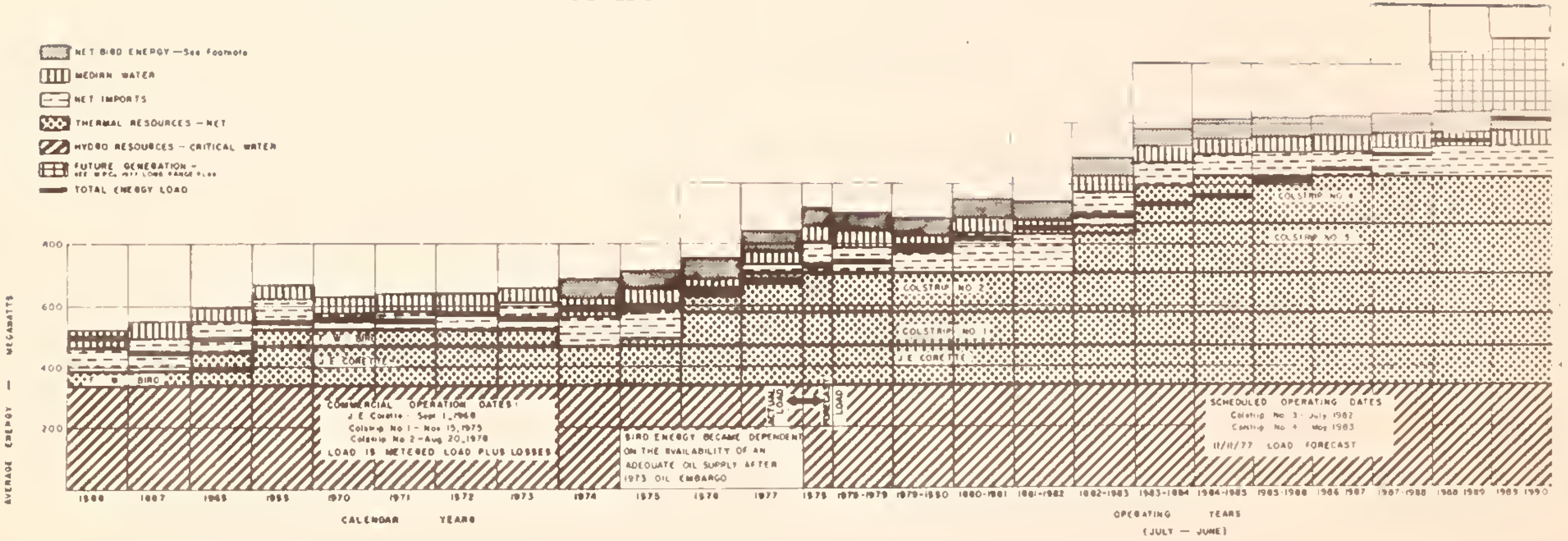
BACKGROUND AND HISTORICAL DEVELOPMENT OF COLSTRIP UNITS #1 AND #2

- THE NEED FOR ELECTRIC ENERGY: THE FORWARD LOOK FROM 1968
    - Projections showed that the Demand would Exceed the Existing Hydro and Thermal Capacity in the Early 1970's due to Montana's Load Growth

- CORETTE PLANT CAME ON LINE IN 1968 TO MEET THE "THEN" DEMAND

- ADDITIONAL GENERATION NEEDED BY MID-1970's

THE MONTANA POWER COMPANY
TOTAL LOADS & RESOURCE CAPABILITIES
ANNUAL ENERGY
COLSTRIP 3 & 4 ON SCHEDULE

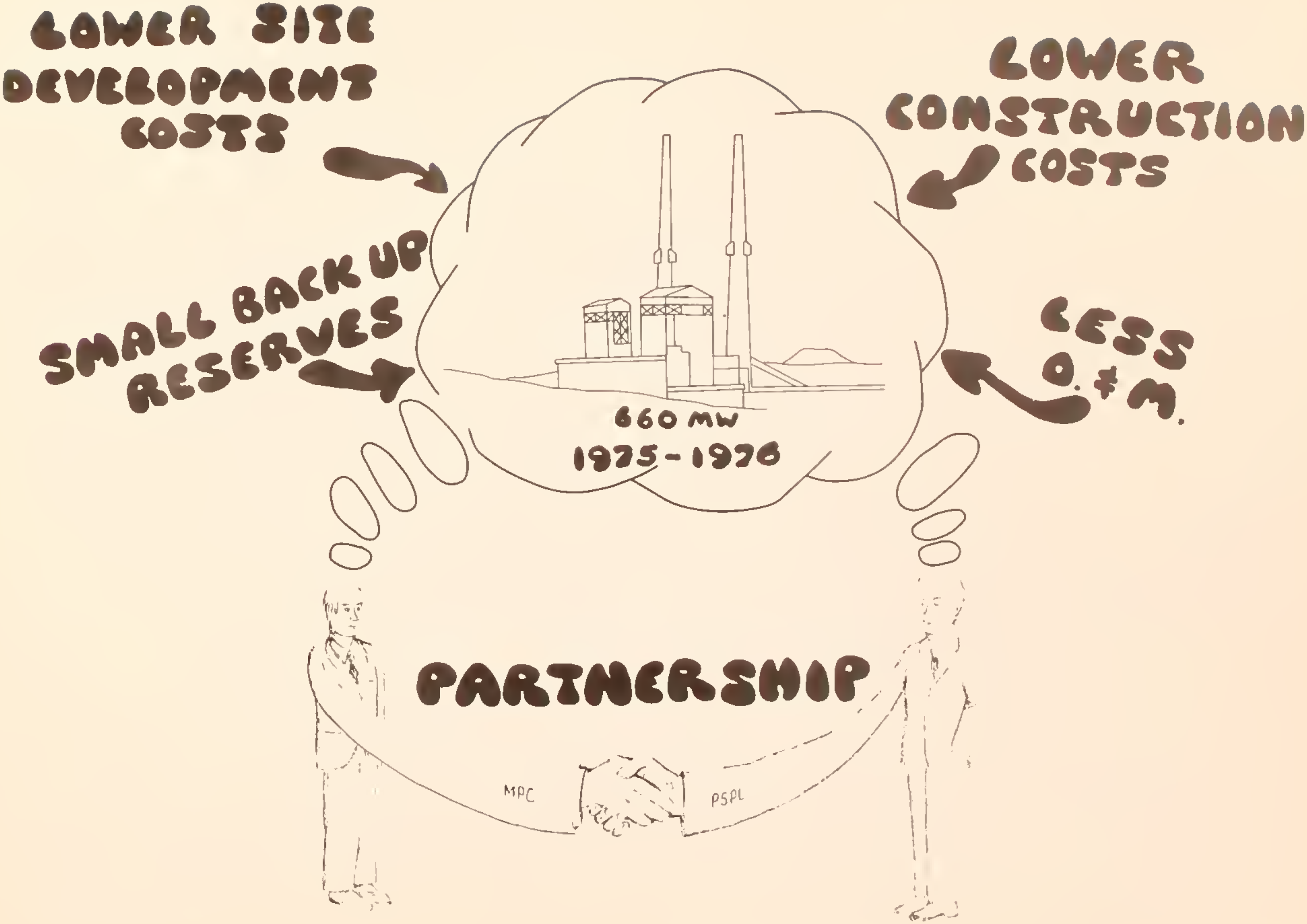


POTENTIAL ENERGY SOURCES CONSIDERED

- HYDRO NOT POSSIBLE BECAUSE OF LICENSING PROBLEMS
  - Buffalo Rapids (potential for 264 MW peak, 120 MW Average (MW years/year)) Couldn't meet time frame (request started in 1955 -- no determination yet)
  - High Mountain Sheep and Pleasant Valley (1953-1968 -- Petition Denied)
- GAS TURBINES NOT APPROPRIATE FOR BASE LOAD REQUIREMENTS -- WE NEED ENERGY AS WELL AS PEAK
- NUCLEAR UNITS NOT SERIOUS CONTENDER BECAUSE OF MONTANA COAL RESOURCES
  - Nuclear Would Be Higher Cost in Montana When Compared to Coal
  - Nuclear Would Be Too Large for the Montana System
- COAL-FIRED UNITS BEST CHOICE
  - Basic MPC Plan Was to Build One Unit Approximately 350 MW -- In Montana to Meet Montana Requirements in 1975

PARTNERSHIP DEVELOPED - 1972

- PUGET SOUND POWER AND LIGHT APPROACHED MONTANA POWER WITH THE PARTNERSHIP IDEA
  - Advantages of the Partnership Building Two Units Instead of One
    - Single project construction of two stations of 330 MW Each
    - Shared and minimized site development costs for Montana Power and consumers
    - Lower construction costs, therefore lower unit cost/KWH is achieved for Montana Power and consumers
    - Achieves lower construction costs per plant because two are built in series with same project management and contracting teams and plant design
    - Lower O&M
      - smaller crew per plant to operate two stations on one site
    - Smaller backup reserves required because:
      - reserve requirements are smaller for smaller plants
      - therefore, two plants shared at 165 MW require lower reserve than one plant at 350 MW
    - Therefore, less capital investment is required
      - lower cost energy is produced
  - At that time, the energy export issue had not come to the forefront


LOWER SITE DEVELOPMENT COSTS
LOWER CONSTRUCTION COSTS
SMALL BACK UP RESERVES
LESS O. & M.
660 MW
1975 - 1976
PARTNERSHIP
MPC
PSPL

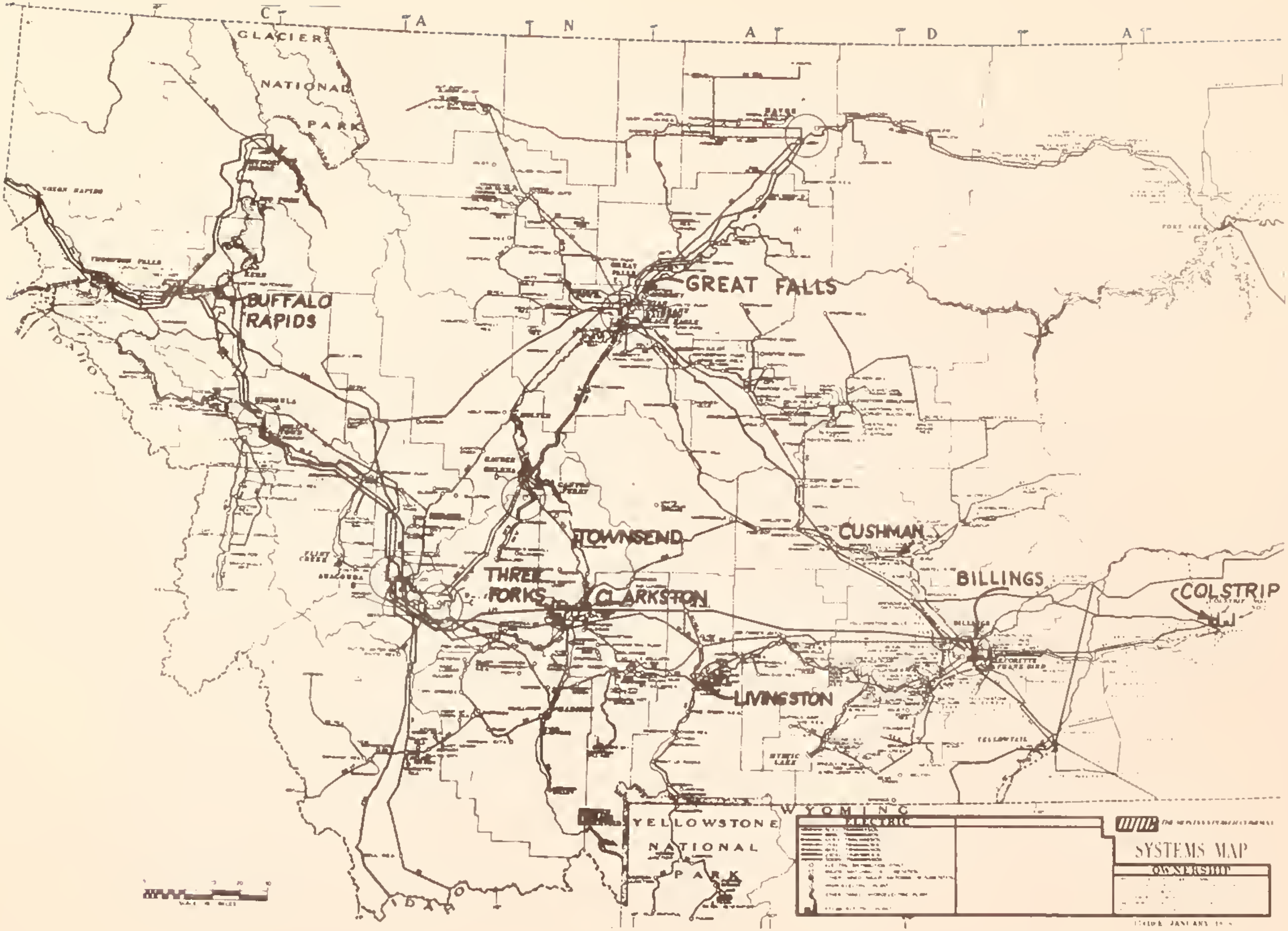
SITE SELECTION

- CRITERIA:
  - Environmental - Air
    - Water
  - Economics - Fuel
    - Freight
    - Water
    - Other
  - Aesthetic

SITES CONSIDERED

- Billings (Eliminated Early Because of Environmental Considerations)
- Townsend
- Clarkston
- Trident
- Livingston
- Great Falls
- Cushman
- Colstrip

COLSTRIP ON ALL POINTS, PARTICULARLY ENVIRONMENTAL AND ECONOMY, WAS CLEARLY BEST


CANADA
GLACIER NATIONAL PARK
BUFFALO RAPIDS
GREAT FALLS
IDAHO
TOWNSEND
CUSHMAN
THREE FORKS
CLARKSTON
BILLINGS
COLSTRIP
LIVINGSTON
WYOMING
YELLOWSTONE NATIONAL PARK
IDAHO
ELECTRIC
SYSTEMS MAP
OWNERSHIP

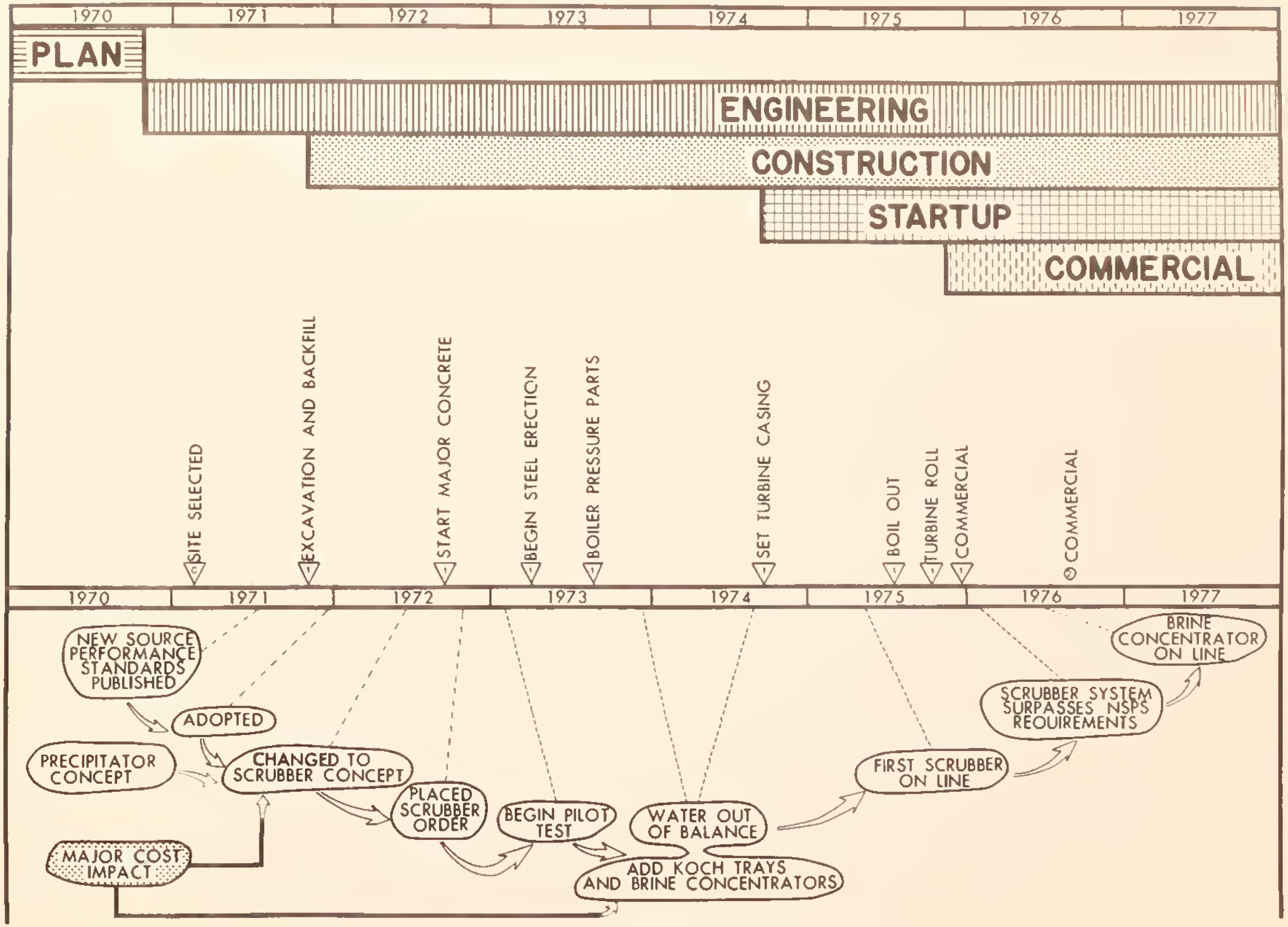
ORIGINAL CONCEPT AND OBJECTIVES

- BASIC OBJECTIVE
  - Reliable Energy Supply, Reasonable Price, Reasonable Profit Compatible With the Environment
- CONCEPT TO MEET OBJECTIVES
  - Two units -- 330 MW each to insure reliable supply of electrical energy
  - Joint ownership with PSP&L
  - Coal Fired Using Colstrip Subbituminous Coal
  - Mine Mouth
  - Water From Yellowstone
  - Transmission Lines Back to the System
    - Transmission was an integral part of the economic trade-off study
  - High Efficiency Gas Cleaning Precipitators
    - Later shifted to scrubbers to meet technical requirements

MAJOR EVENTS AFFECTING CONSTRUCTION COSTS AND TECHNICAL PERFORMANCE

- NEW SOURCE PERFORMANCE STANDARDS PUBLISHED/ADOPTED AFTER COLSTRIP SITE WAS SELECTED AND CONSTRUCTION HAD BEGUN - NOVEMBER 1971
- NEW REQUIREMENTS NECESSITATED CHANGE TO SCRUBBER CONCEPT FROM PRECIPITATOR AFTER ENGINEERING WAS WELL ALONG AND CONSTRUCTION STARTED -- THIS HAD A MAJOR COST IMPACT -- MAY 1972
- SCRUBBER ORDERED AND PILOT PLANT TESTING BEGAN AT THE SAME TIME BOILER/TURBINE-GENERATOR STEEL ERECTION BEGAN -- JANUARY 1973
- WATER FOUND OUT OF BALANCE MID-WAY THROUGH CONSTRUCTION PERIOD -- DECEMBER 1973
    - Add Wash Trays
    - Add Brine Concentrators
- MAJOR COST IMPACT
- EVEN WITH NEW DESIGN AND DEVELOPMENT NEEDED TO CORRECT WATER BALANCE PROBLEMS SCRUBBERS DID NOT DELAY ORIGINAL PLANT START-UP SCHEDULE
- FIRST AND SUBSEQUENT TEST RESULTS FAR BETTER THAN NSPS FEDERAL AIR QUALITY REQUIREMENTS
    - For Example, Results from 14 EPA Compliance Tests on Colstrip Units #1 and #2 show:
        - SO_2 -- Federal standard 1.20 lb/10^6 Btu
            - Test results range .15 to .48
            - Tests average .28
        - Particulate -- Federal Standard 0.10 lb/10^6 Btu
            - Test results range 0.029 to 0.051
            - Test results average 0.035
        - NO_x -- Federal Standard 0.7 lb/10^6 Btu
            - Test results range .25 to .42
            - Tests average .35

COLSTRIP UNITS 1 & 2 MILESTONES



COLSTRIP SCRUBBER SELECTION PROCESS: PERFORMANCE, RELIABILITY, AND ECONOMY - 1

- OBJECTIVE: ACHIEVE CLEAN AIR REQUIREMENTS RELIABLY AND ECONOMICALLY

- 1972 SITUATION: TECHNOLOGY FOR ACHIEVING CLEAN AIR REQUIREMENTS WAS NOT ESTABLISHED
    - State of the Art Was Developmental
    - Three Stations With Installed Pollution Control Equipment Existed in U. S.
        - We visited all three

- TASK: ANALYZE EXISTING TECHNOLOGY
    - Determine Most Likely to Succeed in Terms of:
        - Performance
        - Reliability
        - Economy

- APPROACH
    - Step 1 - Identify All Existing Equipment and Suppliers, Plus Pilot Technology
    - Step 2 - Establish Criteria
    - Step 3 - Narrow to Best Technology
    - Step 4 - Develop Specification for Best Technology
    - Step 5 - Determine Specific Design, Equipment and Manufacturer Most Likely to Achieve Specifications, Reliability and Economic Goals

- HERE'S WHAT WE DID:
  - Step 1 - Existing and Pilot Technology Was Identified As Eight Candidate Processes (See Chart)
  - Step 2 - Key Criteria Were Established As:
    - SO_2 removal
    - Particulate removal
    - No discharge of water to river or water table
    - No bypass of flue gas directly to stack
      - scrubbers on line at all time plant is operating
  - Step 3 - Narrowed Candidates to Best Technology
    - Eliminated systems:
      - Hot precipitator - no SO_2 removal
      - Wet precipitator - experimental, unknown efficiency
      - Bag filters - no SO_2 removal
      - Centrifugal separators - no SO_2 removal
      - Boiler injection sulfur removal systems - no particulate removal
      - Sulfur recovery systems - no particulate removal
      - Precipitator/scrubber - poor operating conditions
    - System of choice:
      - Wet alkali scrubber
        - SO_2 removal
        - particulate removal
        - potential to utilize fly ash alkalinity
        - experimental units

- HERE'S WHAT WE DID:
  - Step 4 - Specifications Were Developed for Wet Alkali Scrubbers:
    - Exit SO_2 1.0 lb/million Btu
    - Exit particulate loading 0.02 grains/acf at stack
    - Utilization of flyash alkalinity
    - Adherence to closed-loop, zero water discharge concept
    - Design details to assure reliability and economy
  - Step 5 - The Manufacturer, Equipment and Design Most Likely to Achieve the Specificiations, Reliability and Economy Were Chosen
    - Bases of Final Selection:
      - meet SO_2 emission specification of 1.0 lb/million Btu
      - meet particulate emission standard of 0.02 grains/acf
      - utilize flyash alkalinity
      - evaluated cost -- including operating cost
      - water consumption -- zero effluent
      - supplemental chemical requirements
      - energy requirements
      - wet VS dry fan
      - wet VS dry stack
      - type of scrubber
      - complexity of system -- number of required vessels
      - bid price

COLSTRIP EMISSION CONTROL SYSTEM SELECTION

	PARTICULATE REMOVAL	SO_2 REMOVAL	EFFICIENCY	STATE OF THE ART 1972	STATE OF THE ART 1978
HOT PRECIPITATOR	YES	NO	GOOD	UNITS IN SERVICE	UNITS IN SERVICE
WET PRECIPITATOR	YES	YES	UNKNOWN	PILOT PLANT	PILOT PLANT
BAG FILTERS	YES	NO	GOOD	PILOT PLANT	EXPER. UNITS
CENTRIFUGAL SEPARATORS	YES	NO	POOR	UNITS IN SERVICE	UNITS IN SERVICE
BOILER INJECTION SULFUR REMOVAL SYSTEMS	NO	YES	UNDEPENDABLE	UNITS IN SERVICE	PROJECTS ABANDONED
SULFUR RECOVERY SYSTEMS	NO	YES	POOR	PILOT PLANT	UNITS UNDER CONSTRUCTION
PRECIPITATOR/ SCRUBBER	YES	YES	GOOD	UNITS IN SERVICE	UNITS IN SERVICE
WET ALKALI SCRUBBERS	YES	YES	GOOD	EXPER. UNITS	UNITS IN SERVICE

WET ALKALI SCRUBBER CHOSEN BASED ON:

ABILITY TO MEET EPA NEW SOURCE EMISSION STANDARDS FOR BOTH SO_2 AND PARTICULATES WITHOUT REGARD TO COAL-SULFUR CONTENT, ASH CONTENT, INLET GAS TEMPERATURE LEVEL, TEMPERATURE DISTRIBUTION OR SOLIDS DISTRIBUTION.

LOWEST OVERALL OPERATING COSTS

- RESULT FROM EVALUATION OF THE BASES:
  - CEA Was Selected From All the Bidders On the Bases Of:
    - Lowest guarantee of particulate emissions
    - Lowest evaluated cost (including operating cost)
    - Lowest water consumption
    - Lowest energy requirements
    - Minimum number of vessels to accomplish the task
    - Lowest bid price consistent with specification
    - In addition, CEA had:
      - conformed most closely to the engineering specification
      - proven engineering talent
      - working arrangement with Arthur D. Little, Inc.
        - in depth technical support
- REGARDING COST AND PERFORMANCE:
  - CEA Was Number 1 Among All Bidders Primarily Because Of:
    - MPC estimate of their performance
    - Their performance guarantees
    - Costs

COLSTRIP SCRUBBER SELECTION PROCESS: PERFORMANCE & COST

COMPANY		*GUARANTEED EMISSION OF SO_2 IN lbs/10^6 BTU	**GUARANTEED EMISSION OF PARTICULATE IN GRAIN/ACF	DOES UNIT TAKE ADVANTAGE OF FLY ASH ALKALINITY ?	COST, $ MILLION	
					BID PRICE	BID PRICE PLUS EVALUATION***
CHEMICO		1.0	0.02	YES	14.6	24.3
RESEARCH COTTRELL	BASE	1.0	DID NOT MEET SPEC.	YES	11.7	22.6
	ALT.	1.0	0.02	YES	12.6	23.7
BABCOCK & WILCOX		1.0	N.A.	YES	17.2	27.0
PEABODY	BASE	1.0	0.02	YES	13.5	23.5
	ALT. 1	1.0	0.02	YES	14.2	24.1
	ALT. 2	1.0	0.02	YES	13.6	23.3
C. E. A.	BASE	1.0	0.018	YES	11.7	21.2
	ALT.	1.0	0.018	YES	11.8	21.2

* FED. STANDARD FOR SO_2 EMISSION IS 1.2 lbs./10^6 BTU M.P.C. STANDARD FOR SO_2 EMISSION IS 1.0 lbs./10^6 BTU

** STANDARD FOR PARTICULATE EMISSION 0.02 GRAIN/ACF
N.A.- INFORMATION NOT AVAIL.

*** EVALUATION: ESTIMATED OPERATING $ + ADJUSTMENT COST

COLSTRIP SCRUBBER PROCESS: ENERGY & MATERIAL USAGE

COMPANY		WATER CONSUMPTION 100% LOAD IN GPM	USAGE OF RAW MATERIALS		ENERGY REQUIREMENTS IN KW
			LIME CONSUMPTION 100% LOAD IN lb/hr	SODA ASH CONSUMPTION 100% LOAD lb/hr	
CHEMICO		N.A.	3,240	NOT OFFERED	11,090
RESEARCH COTTRELL	BASE	352	NOT OFFERED	170	11,110
	ALT.	396	NOT OFFERED	1320	11,260
BABCOCK & WILCOX		N.A.	NOT OFFERED	N.A.	N.A.
PEABODY	BASE	408	280 AND 900		12,408
	ALT. ①	408	280 AND 900		11,240
	ALT. ②	408	280 AND 900		11,240
C.E.A.	BASE	369	1286 OR 1872		7,453
	ALT.	369	1256 OR 1872		7,453

N.A. = INFORMATION NOT AVAILABLE

COLSTRIP SCRUBBER SELECTION PROCESS: SYSTEM DESCRIPTION

COMPANY		TYPE OF FAN DRY OR WET	TYPE OF STACK DRY OR WET	TYPE OF SCRUBBER	TOTAL VESSELS PER UNIT
CHEMICO		**WET**	**WET**	VENTURI	14
RESEARCH COTTRELL	BASE	**WET**	**WET**	FLOODED DISC	6
	ALT.	**DRY**	**WET**	FLOODED DISC	6
BABCOCK & WILCOX		**DRY**	**DRY**	VARIABLE THROAT VENTURI	9
PEABODY	BASE	**DRY**	**DRY**	RADIAL FLOW SCRUBBER	16
	ALT. ①	**WET**	**DRY**	RADIAL FLOW SCRUBBER	16
	ALT. ②	**WET**	**WET**	RADIAL FLOW SCRUBBER	16
C.E.A.	BASE	**DRY**	**DRY**	ANNULAR VENTURI	**4**
	ALT.	**WET**	**WET**	ANNULAR VENTURI	**4**

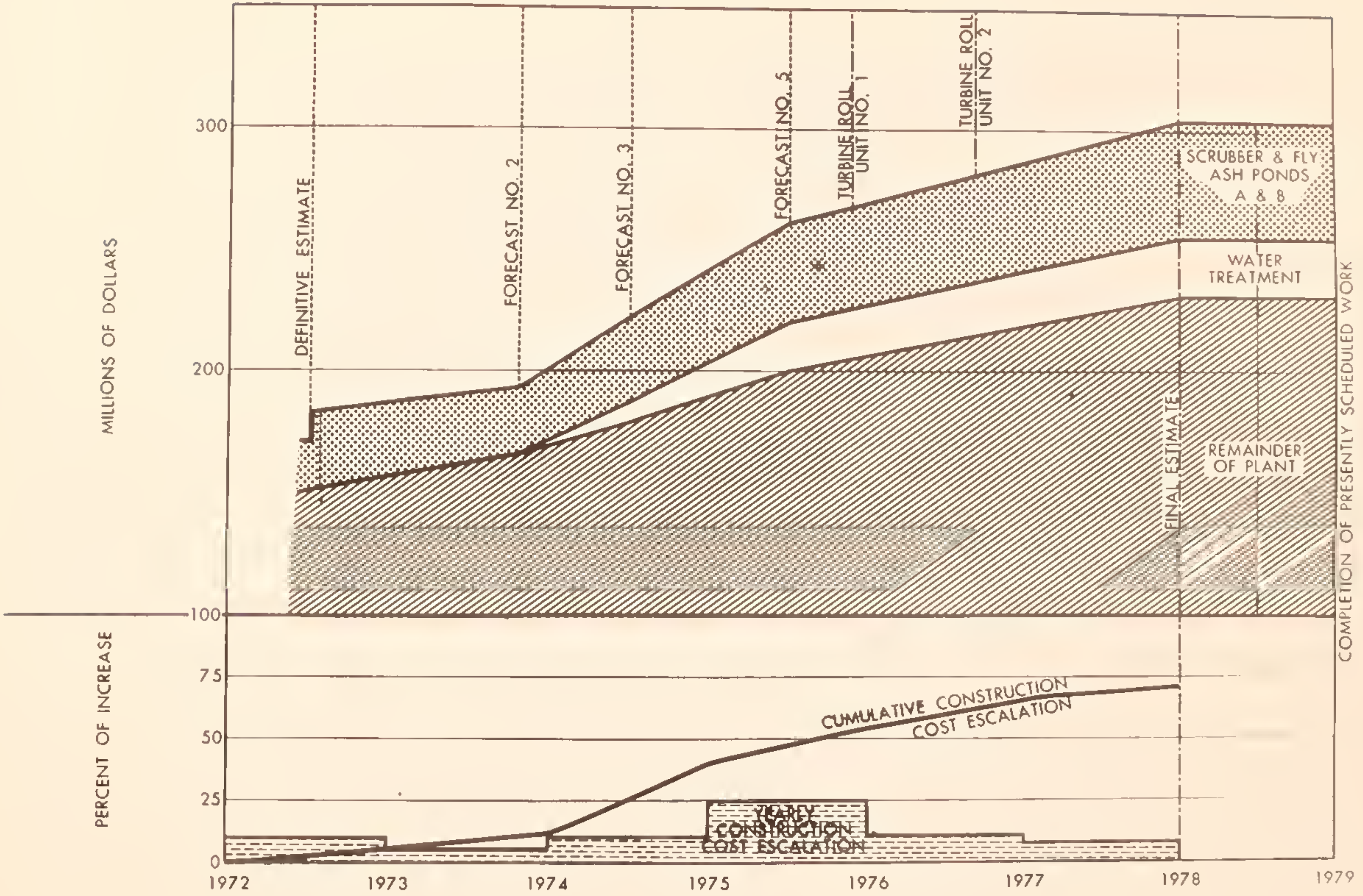
- SUMMARY OF FINAL SELECTION
  - Overriding Considerations Were:
    - Meeting the clean air specifications
    - Estimated reliability of performance based on:
      - design
      - known state-of-the-art (limited)
    - Economics -- cost VS performance
    - Future performance in terms of maintenance, operating costs and reliability
  - Entire Evaluated Bid Cost Range Was Within 27% of the Low Bid
    - Cost, on the stand-alone basis, was not the deciding factor in the final selection

- IN SUMMARY, WHAT WAS IMPORTANT WAS MEETING CLEAN AIR OBJECTIVES, RELIABILITY OF PERFORMANCE AND FUTURE OPERATING COSTS

HISTORY OF COLSTRIP COST DEVELOPMENT - OVERVIEW

- BASE OBJECTIVE -- LEAST COST ENERGY SUPPLY, RELIABLE, ENVIRONMENTALLY COMPATIBLE
- 1972 - 1976 TIME FRAME
    - Inflation
    - Recession
    - Rapid Cost Escalation in Construction
    - Extended Procurement Cycles
    - Basic Material Shortages
- INTRODUCTION OF NATIONAL CLEAN AIR AND CLEAN WATER ACTS
    - National and State Goals
    - Affected Technical Performance Requirements
- NEW CLEAN AIR REQUIREMENTS ACT AFFECT TECHNOLOGICAL REQUIREMENTS
    - Impact On Colstrip
        - Front-end change from precipitator to scrubbers
        - Mid-point requirement for new design and development of water balance system to support environmental system
        - Overall cumulative effect: $183 million original estimate to $304 million final cost
            - further detailed in following charts
        - Results -- working plant that performs better than required air standards
        - Next, some perspective -- Colstrip costs and technical performance compared with similar installations in the U. S.

HISTORY OF COSTS

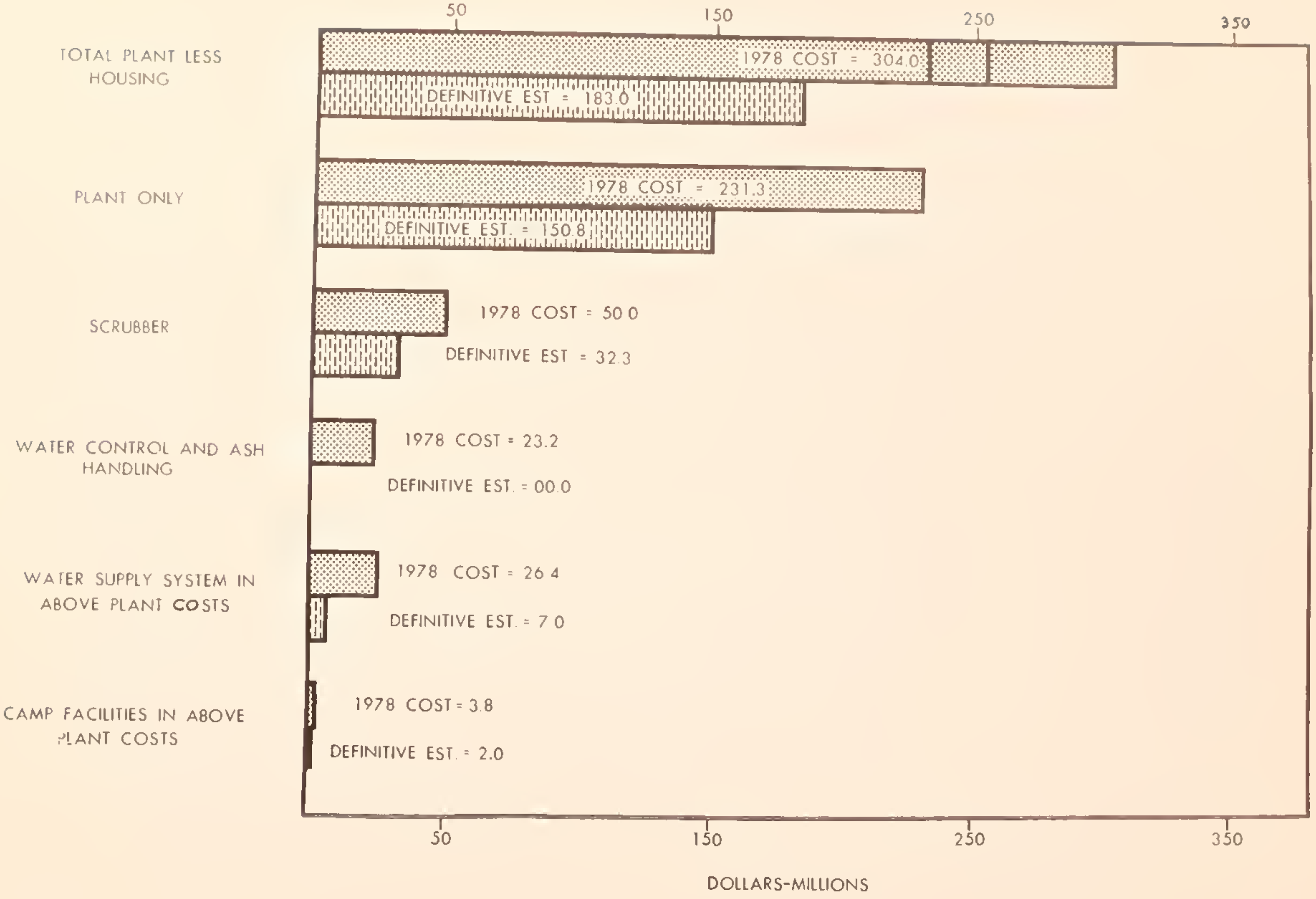


REASONS FOR PROJECT COST INCREASES

- EXPANDED SYSTEMS
    - Precipitator Changed to Scrubber
    - Expanded Scrubber System
    - 70% Costs Escalation During the Period of Construction
    - Water Supply System Expansion
        - Design, development and installation of the water balance system at Project Midpoint
- RESULT -- PROJECT COST INCREASED FROM
    - 183 Million to 304 Million

COLSTRIP 1&2 COSTS

1972 DEFINITIVE ESTIMATE -VS - FINAL



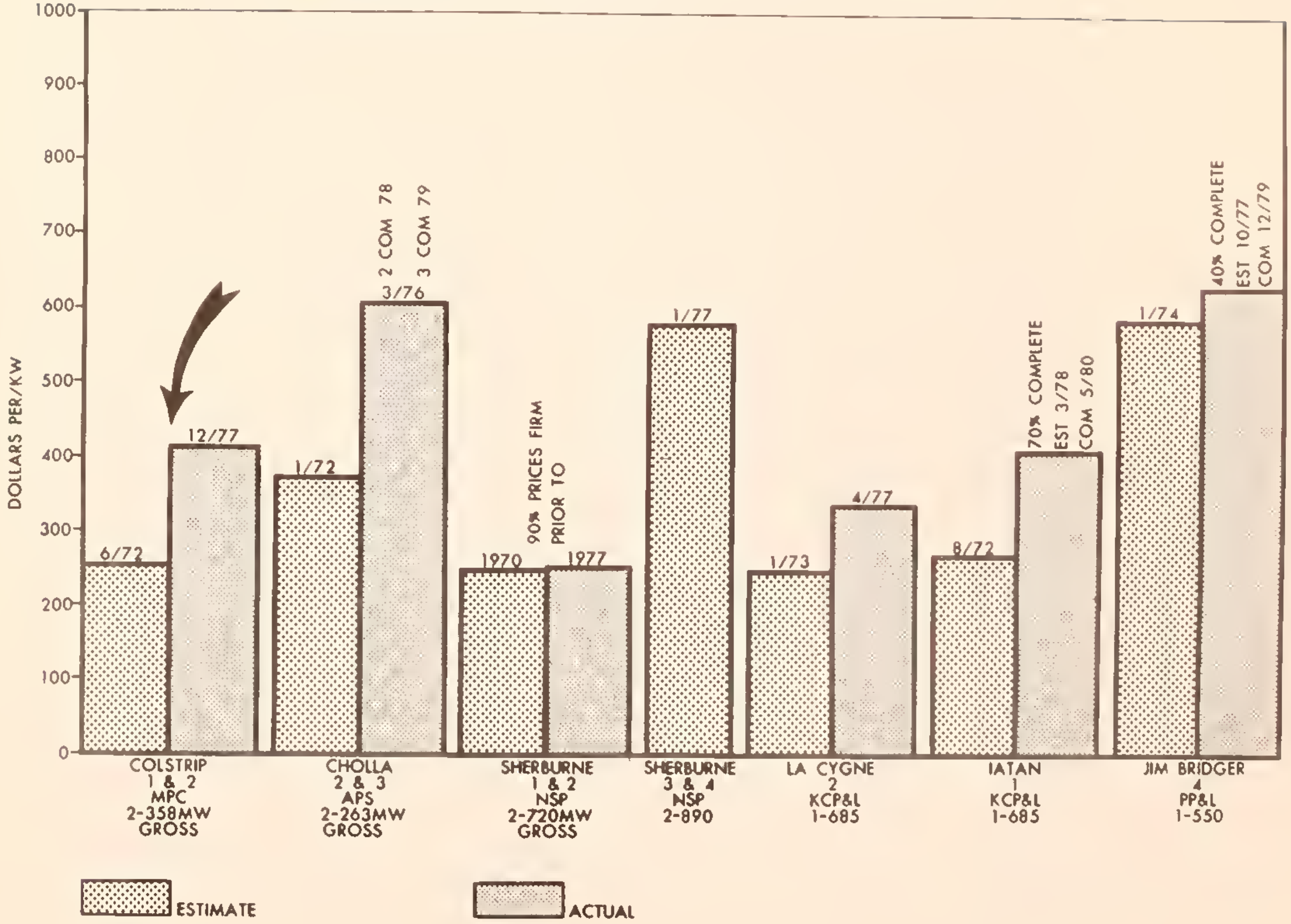
COLSTRIP COST PERFORMANCE IN PERSPECTIVE: COMPARATIVE PLANT COST DATA

- PURPOSE
  - To Compare Colstrip Cost Performance With Other Plants
    - As a means of measuring success in attaining:
      - cost goals/results
      - technical performance goals
- APPROACH
  - Acquire Original Cost Estimate VS Actual Data From Comparable Plants in the U. S.
- LIMITATION
  - Each Plant in U. S. Built for Specific Circumstances at Particular Time
    - In that sense, each is unique
    - Therefore absolute "100%" comparisons are not possible
- EFFECTS
  - Adjustments For:
    - Time frame/inflation
    - Environmental control equipment design and selection
    - Size of plant VS cost per kW
  - Produce Reasonable, Appropriate Indices of Comparison

COLSTRIP COSTS IN PERSPECTIVE - 1

- "RAW" OR "UNADJUSTED" COST COMPARISONS
  - Basic Point is That All Utilities Had Similar Difficulties in Estimating in 1970-1975 Period:
    - High cost escalation
    - New technology requirements, never before designed, built and operated
  - MPC Shared That Experience
- SOURCE OF ORIGINAL ESTIMATE DATA IS FROM THE VARIOUS PLANT OPERATORS
- HIGHER COST/KW FOR PLANTS BUILT AFTER 1977 --
  - Added Equipment
  - Increased Cost of Material and Labor
  - Example: Bridger #4, Iatan, Sherburne 3&4 (contrast "pre" and "post" 1978 projects)
    - Sherburne 1&2 shows effects of 1970 fixed price contracts
    - Sherburne 3&4 is subject to same factors as all others

PLANT COMPARISONS
PRELIMINARY ESTIMATES VS ACTUAL COST

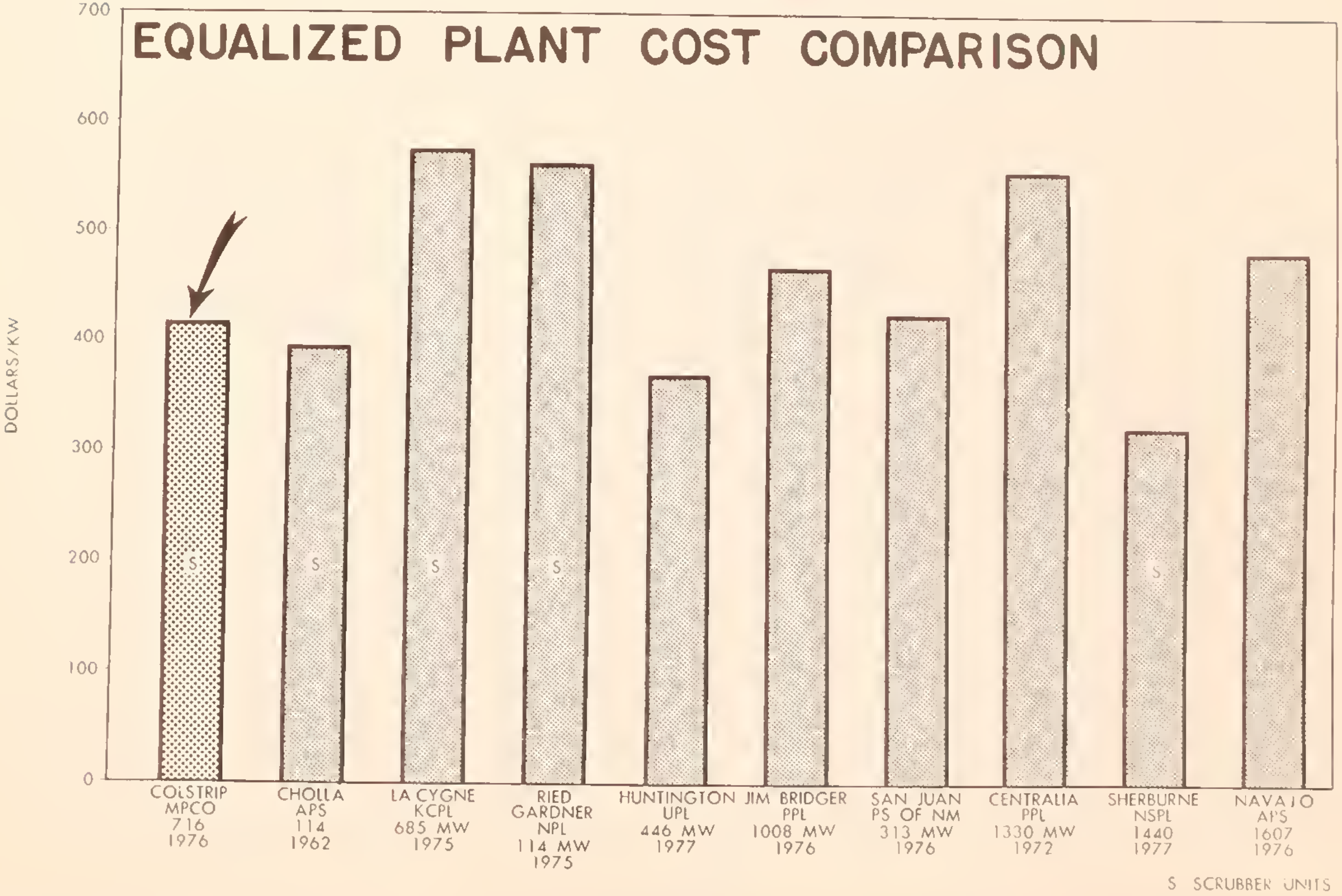


COLSTRIP COSTS IN PERSPECTIVE - 2

- EQUALIZED PLANT COST COMPARISON
  - Basic Costs Data Source: FPC/FERC Reports 1974-1977
  - Equalizing Adjustments
    - Time adjustments to correct inflation to December 1976
    - Adjusting the per/kW costs for comparable size of plant
    - Adjust component mix to most nearly "match" Colstrip
      - 30 mile pipeline
      - surge pond
      - closed loop water system
      - scrubber
      - construction housing
    - Not possible to adjust for remote labor and shipping factors
- RESULT: COLSTRIP COMPARES FAVORABLY WITH COMPARABLE PLANTS

DECEMBER 1976 DOLLARS PER KW

COLSTRIP COMPARED TO OTHER PLANTS ADJUSTED FOR SIZE, SIMILAR COMPONENTS & TIME FRAME/INFLATION FACTOR



EQUALIZED PLANT COST COMPARISON

ECONOMICS OF ENERGY

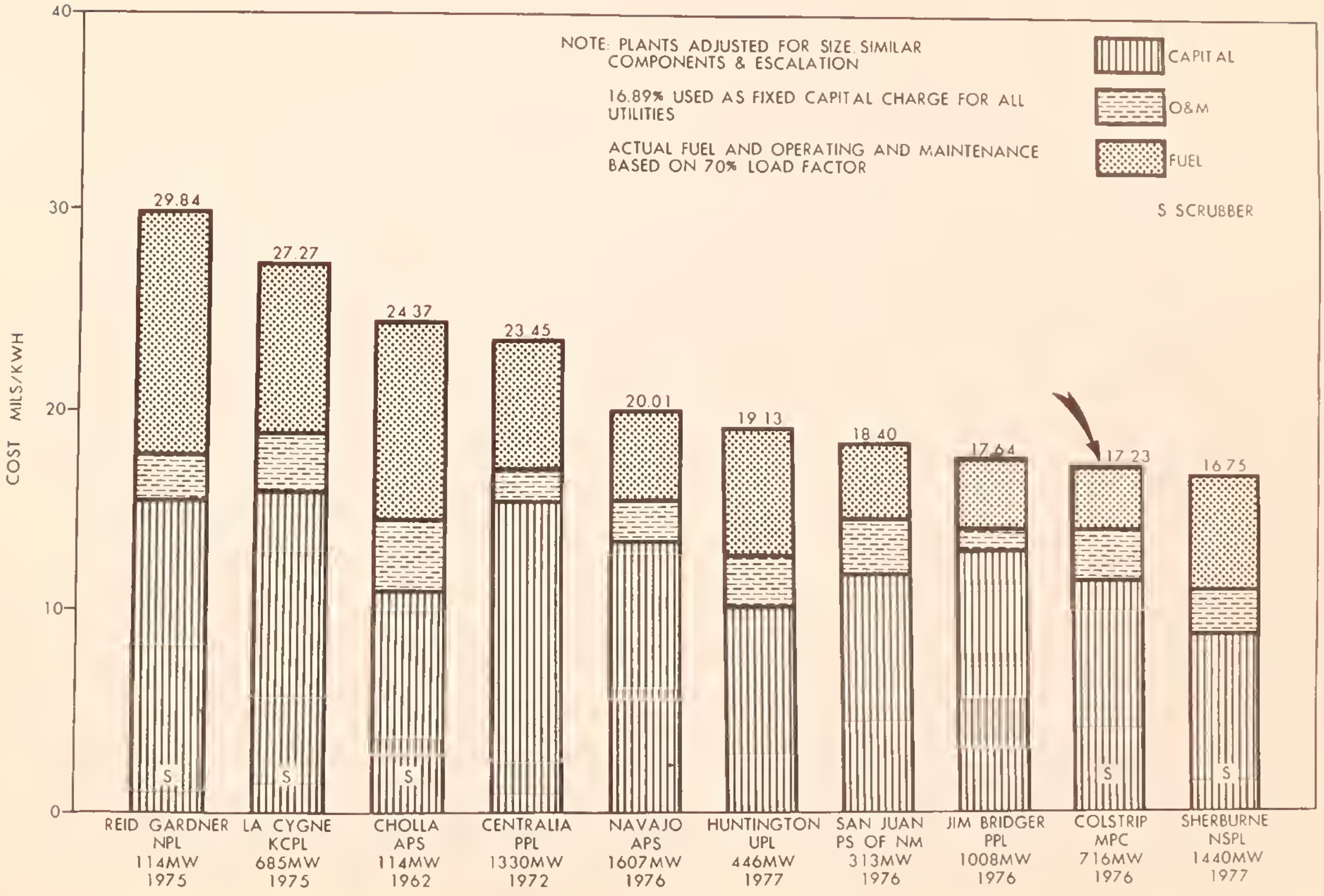
*PURPOSE OF CHART COMPARISON OF ESTIMATED LEVELIZED BUSBAR COSTS: IT IS A MEANS OF MEASURING COST EFFECTIVENESS OF COLSTRIP #1 AND #2

- Ground rules applied:
- 16.89 Fixed Capital Charge For all Stations (Estimate Based on MPC Analysis)
- 70% Load Factor
- O & M Costs from FPC/FERC Reports (1977)
- Fuel Costs from FPC/FERC Reports (1977)
- Adjusted For Size of Plant VS Per Kilowatt Cost
- Adjusted For Equivalent Environmental Control Equipment
- Adjusted For Time Frame/Inflation Effects (to December 1976)

*COLSTRIP ENERGY COST IS BELOW AVERAGE OF SAMPLE

*GOAL OF PROVIDING LOW COST RELIABLE ENERGY IS ACHIEVED

ESTIMATED LEVELIZED BUS BAR COST MILS/KWH



NOTE: PLANTS ADJUSTED FOR SIZE, SIMILAR COMPONENTS & ESCALATION

16.89% USED AS FIXED CAPITAL CHARGE FOR ALL UTILITIES

ACTUAL FUEL AND OPERATING AND MAINTENANCE BASED ON 70% LOAD FACTOR

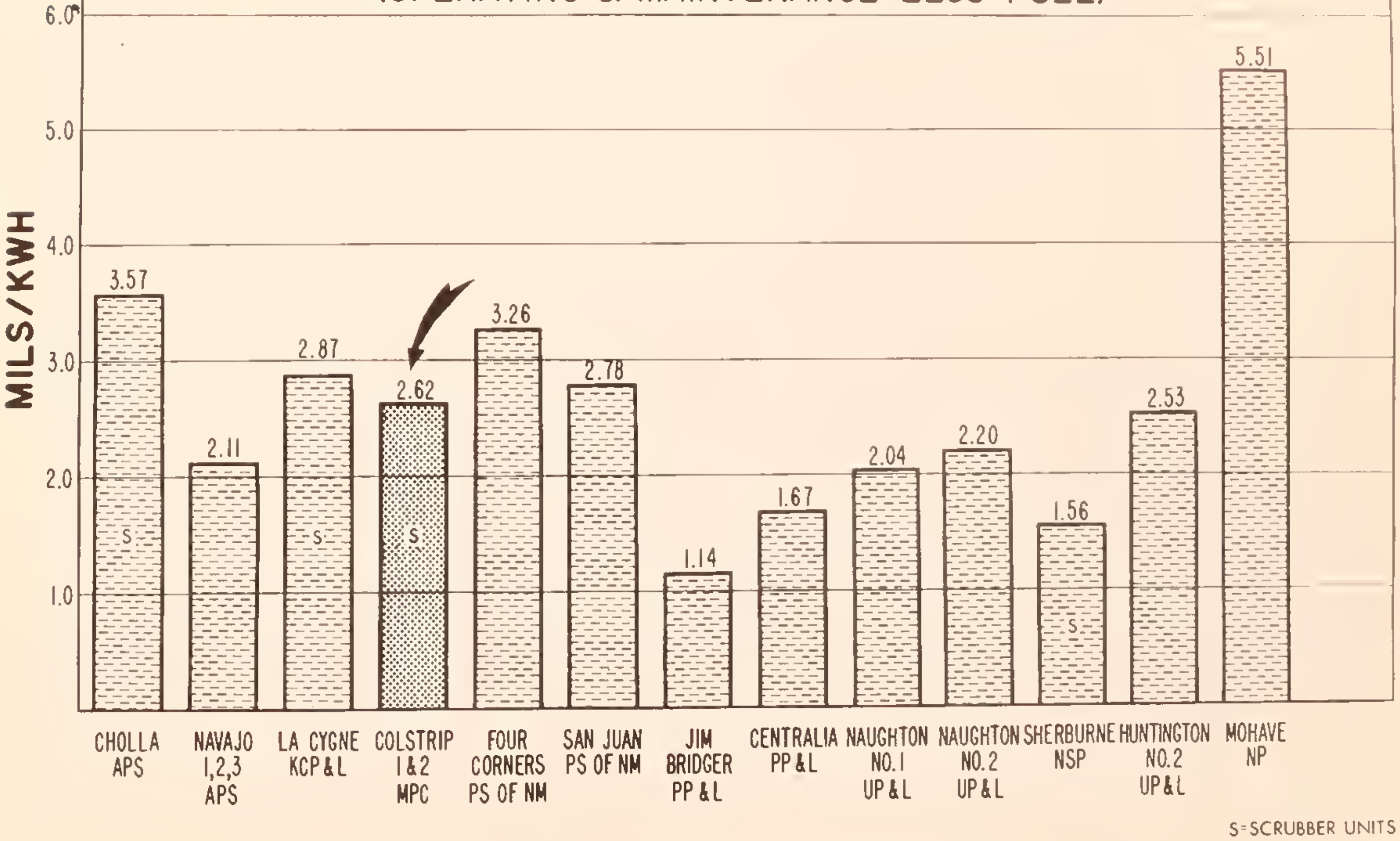
ECONOMICS OF ENERGY

- PLANT OPERATING & MAINTENANCE COST COMPARISON (NO FUEL)
  - Colstrip O&M 2.62 Mils/kWh in 1977
  - Average of Plants Compared is 2.58 Mils/kWh
    - Colstrip approximately "average" O&M cost
  - Highest Of Plants Compared 5.51 Mils/kWh
    - Lowest = 1.14
  - Most Units Having Lower O&M Costs Do Not Have Scrubber or Zero Effluent Plant

THERMAL *OPERATING & MAINTENANCE MILS/KWH

COMPARATIVE FROM 1977 FPC FORM 1

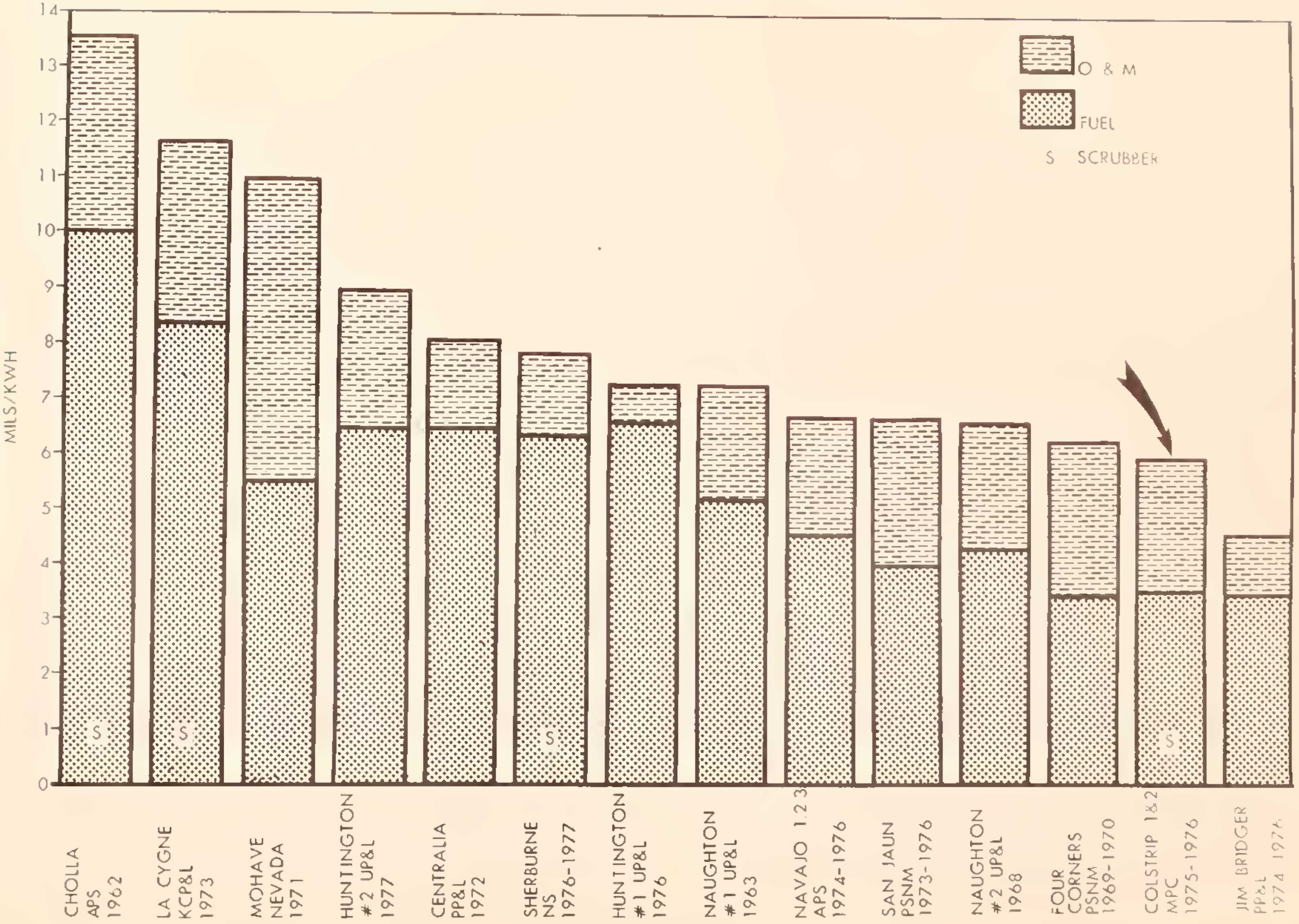
*(OPERATING & MAINTENANCE LESS FUEL)



ECONOMICS OF ENERGY

- PLANT OPERATION & MAINTENANCE COMPARISON (FUEL INCLUDED)
  - Fuel Is a Major Cost of Operating a Plant
  - With Fuel Factored Into O&M Costs - Colstrip Is Nearly the Lowest Cost Unit to Operate
    - Benefit of Montana coal, minemouth operation
  - Jim Bridger ... Three Identical Units ... Advantage of Similarity and Experience

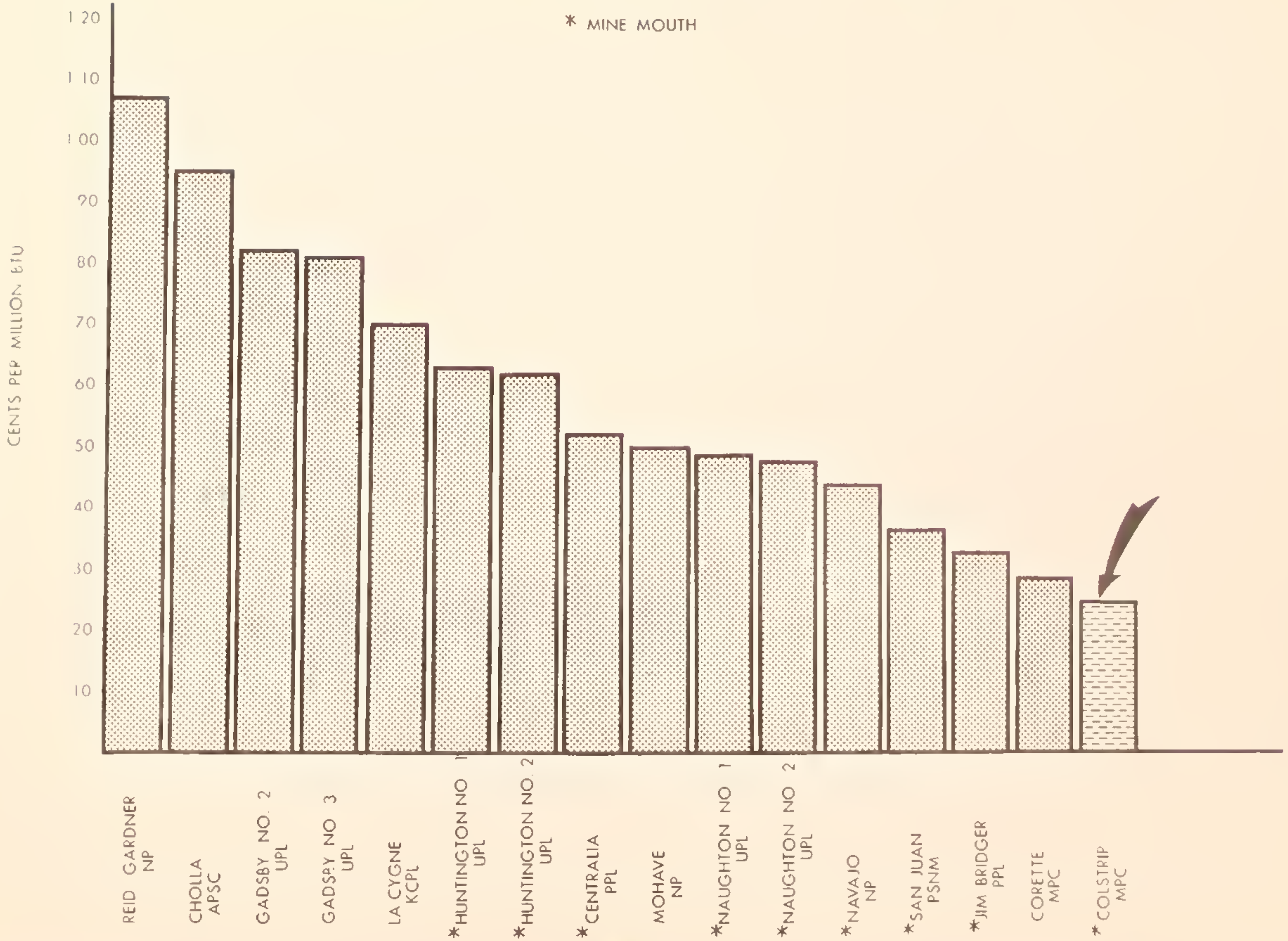
O & M COST INCLUDING FUEL
FROM 1977 FPC FORM I



ECONOMICS OF ENERGY

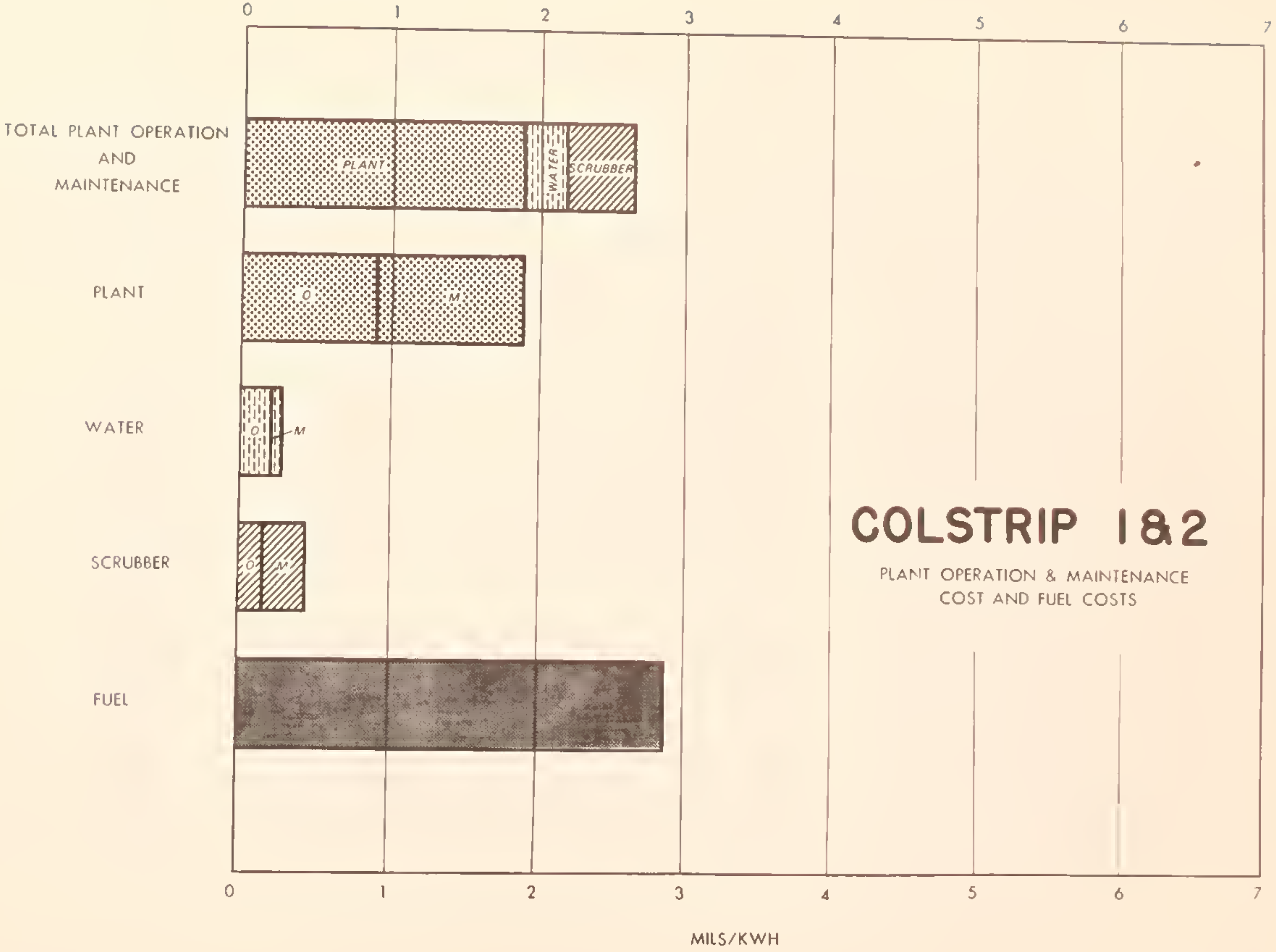
- FUEL COSTS
  - Rosebud Coal Costs Nearly Lowest In Nation

COST OF COAL-1977



ECONOMICS OF ENERGY

- COLSTRIP O&M COST BREAKDOWN
    - Plant Only O&M Costs = 1.89 Mils/kWh
    - Water Treatment and Recycling O&M Costs = .29 Mils/kWh
    - Scrubber O&M Costs = .45 Mils/kWh
    - Scrubber and Water Treatment O&M Costs Make Up 28% of Total Plant O&M Costs



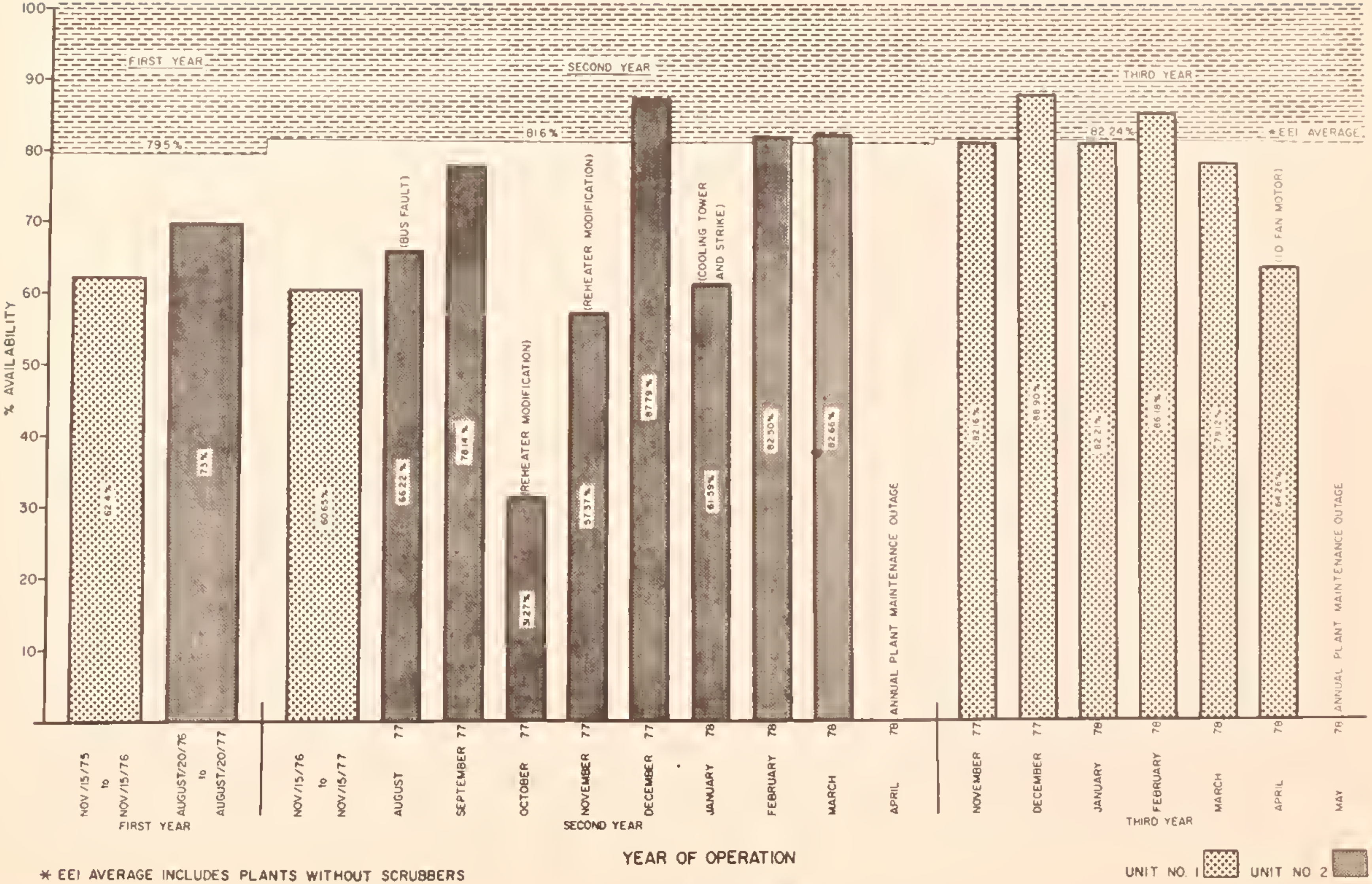
COLSTRIP 1&2

PLANT OPERATION & MAINTENANCE
COST AND FUEL COSTS

ECONOMICS OF ENERGY

- COLSTRIP PLANT AVAILABILITY
  - EEI Average Includes All Plants Most of Which Do Not Have Scrubbers or a Zero Effluent System
  - Design and Manufacturing Deficiencies Cause Numerous Curtailments and Outages In First Few Years
    - Industry wide "shakedown" experience
  - Experienced Operating Personnel Hard to Find
    - Recruitment and training progressing well
  - Modifications and Training Paying Dividends -- Recent Availabilities Near and Above Average

PLANT AVAILABILITY



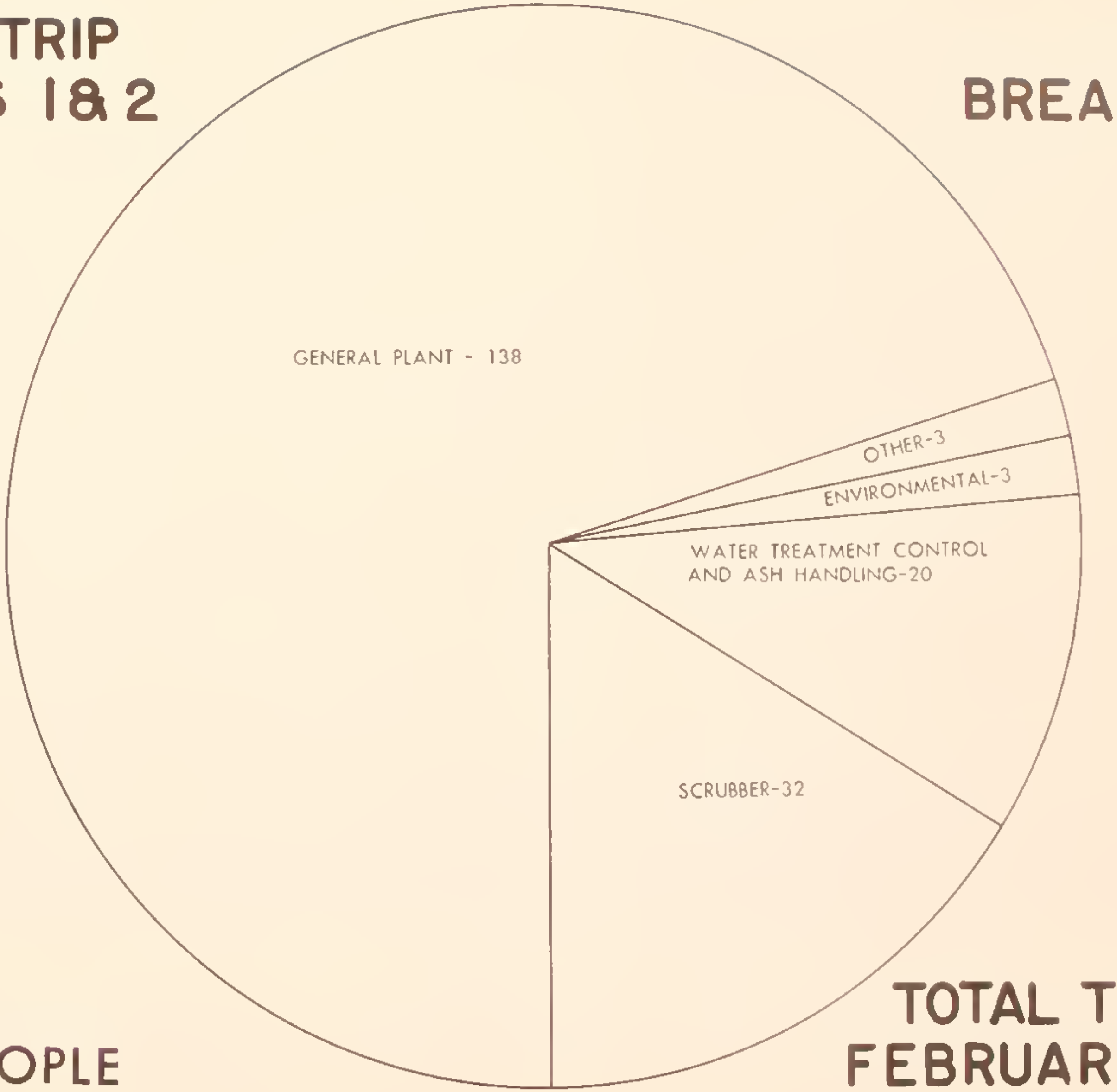
* EEI AVERAGE INCLUDES PLANTS WITHOUT SCRUBBERS

COLSTRIP STAFFING

GENERAL PLANT	= 138	70.4%
SCRUBBER	= 32	16.4%
WATER TREATMENT, RECYCLING AND ASH HANDLING	= 20	10.2%
ENVIRONMENTAL	= 3	1.5%
OTHER	= 3	1.5%
TOTAL	= 196	100.0%

COLSTRIP UNITS 1& 2

STAFF BREAKDOWN



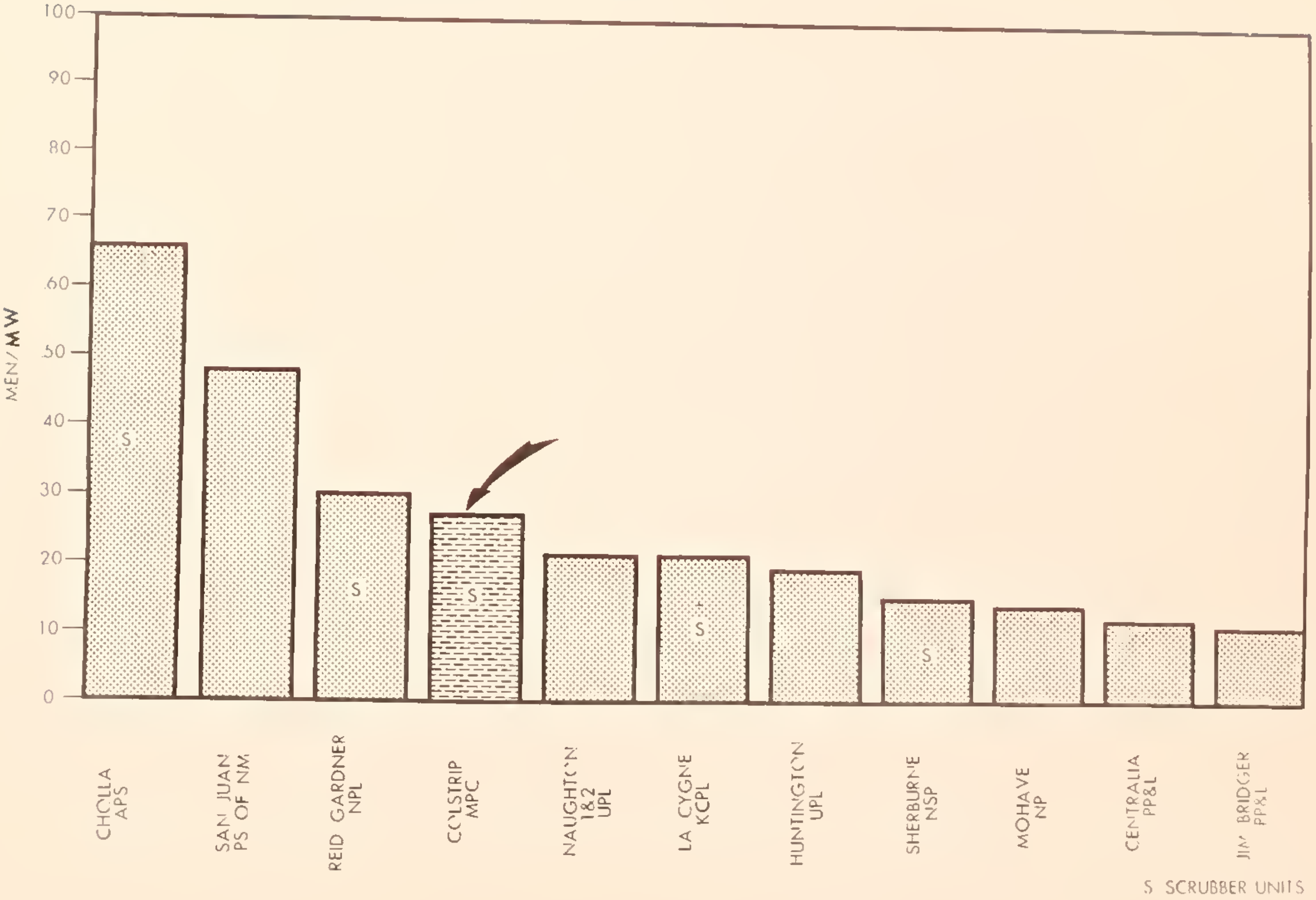
196 PEOPLE

TOTAL THROUGH FEBRUARY 1978

COLSTRIP STAFFING

- PLANT STAFF COMPARISON
  - Not the Lowest
  - Not the Highest
  - Statistics Not Adjusted for Plant Size Factor
  - Colstrip's .27 Men/MW Compares With Average of .26 Men/MW
  - Good When You Consider Not All Units Have Scrubbers On Zero Effluent Situation

PLANT STAFF COMPARISON



COLSTRIP SCRUBBER

- SELECTED AFTER INTENSIVE INVESTIGATION OF STATE-OF-THE-ART
- CEA FINALLY SELECTED BASED ON:
  - Conformance to Specification - Technical Ability to Meet Clean Air Requirements
  - Proven Engineering Talent
  - CEA's Working Arrangement With Arthur D. Little, Inc.
    - In depth technical support
  - Lowest Price Consistent With Highest Quality Design
- SCRUBBER PERFORMS DUAL FUNCTION
  - Particulate Removal
  - SO_2 Removal
- NO BY-PASS -- SCRUBBERS ON-LINE AT ALL TIME PLANT IS OPERATING
- NO DISCHARGE TO ANY BODY OF WATER OR WATER TABLE

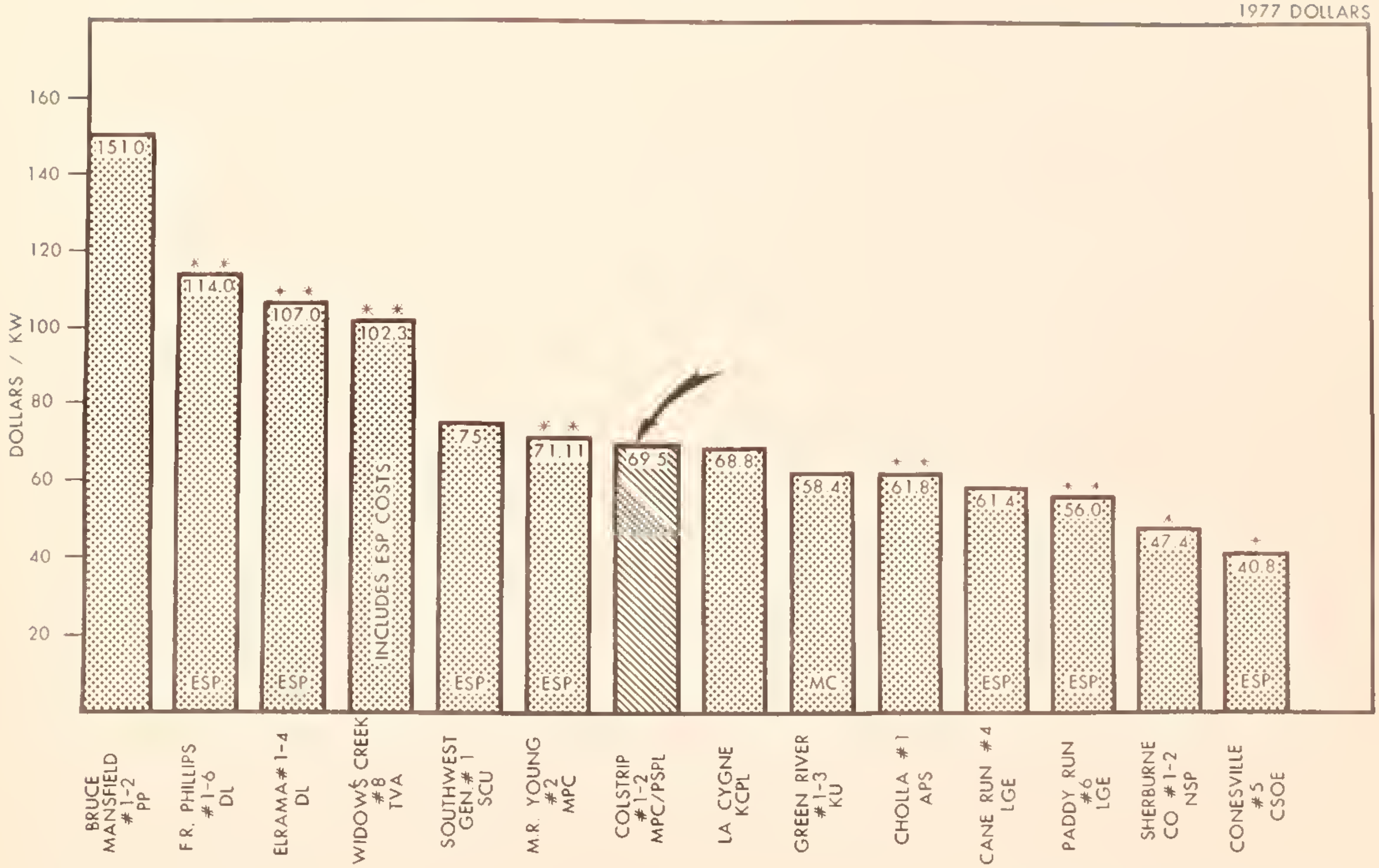
COLSTRIP SCRUBBERS (CONT'D)

- DESIGN UTILIZES ALKALINITY IN THE ASH FOR SO_2 ABSORPTION
  - Highly Effective Cost Wise and Technically
- DESIGN UTILIZED RESULTS OF PILOT TESTING
- DESIGN INCORPORATED IMPROVEMENT DEVELOPING THROUGHOUT THE UTILITY INDUSTRY
- ALL FOR THE PURPOSE OF PROVIDING A SYSTEM WHICH WOULD CONSISTENTLY MEET EMISSION STANDARDS
  - Without a Bypass
  - Without Discharging to Any Natural Body of Water

SCRUBBER CAPITAL COSTS

- INSTALLED COST OF COLSTRIP SCRUBBERS - $69/KW
- LOWER THAN AVERAGE OF $77/KW
- DATA COLLECTION AND REPORTING NOT STANDARDIZED IN INDUSTRY
  - Some Omit Direct Costs
  - Some Omit Waste Disposal Facilities

COMPARATIVE SCRUBBER CAPITAL COSTS



* DIRECT COST ONLY
** WASTE DISPOSAL NOT INCLUDED

ESP-ELECTROSTATIC PRECIPITATOR (COST NOT INCLUDED)
MC-MECHANICAL COLLECTOR (COST NOT INCLUDED)

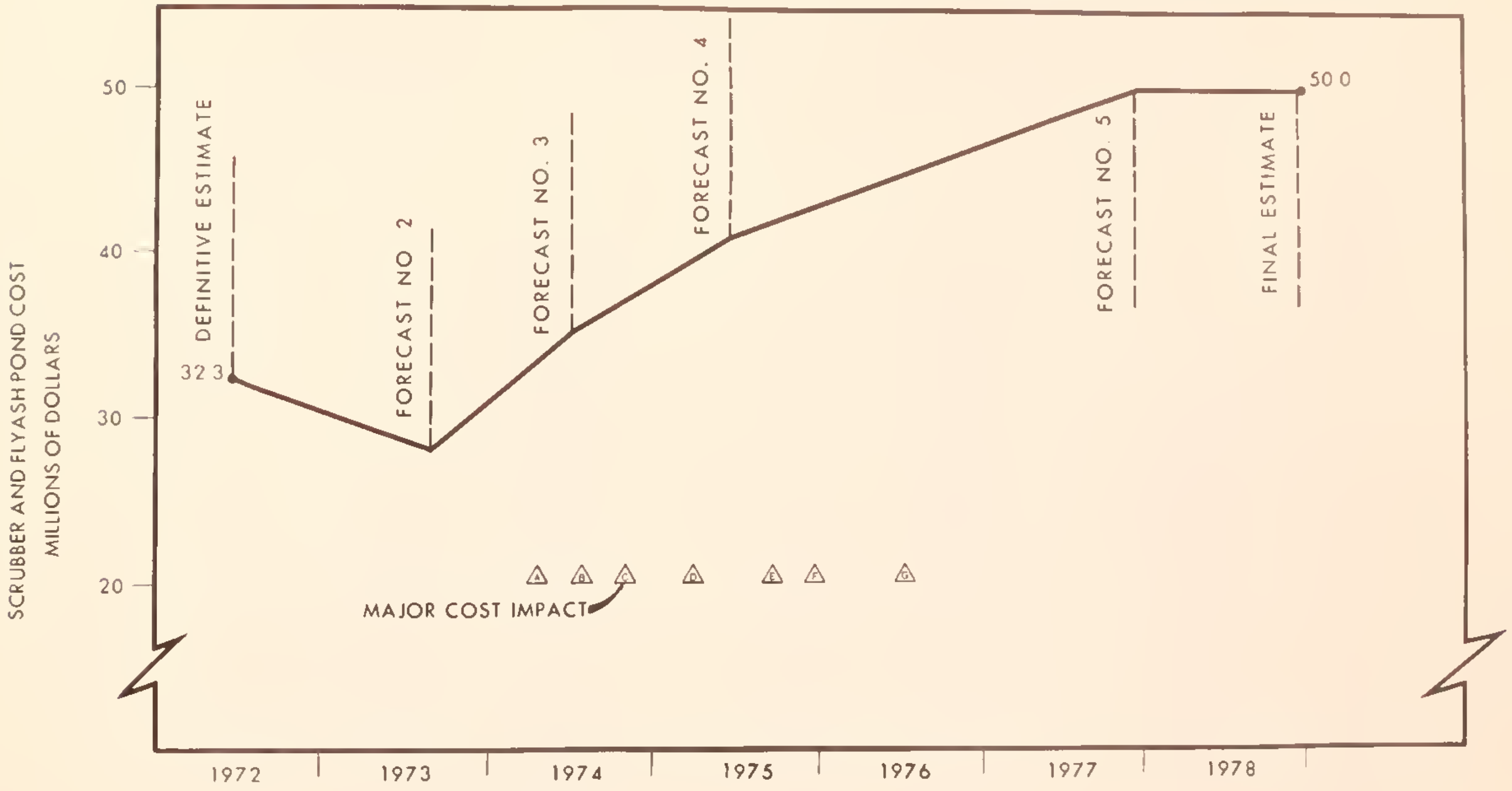
MAJOR EVENTS IN SCRUBBER/CLEAN AIR/CLEAN WATER DEVELOPMENT

- 1972 - NO HARDWARE OR PROVEN TECHNOLOGY EXISTED TO MEET THE AIR QUALITY OBJECTIVES

- PROJECT BY ITS NATURE WAS RESEARCH, DEVELOP, TEST, CONSTRUCT AND TEST

- AS DEVELOPMENTAL AND TESTING PHASES PROGRESSED, NEW TECHNICAL REQUIREMENTS WERE DEFINED
  - These Added Costs to Meet the Objectives

MAJOR EVENTS IN SCRUBBER/CLEAN AIR/CLEAN WATER DEVELOPMENT



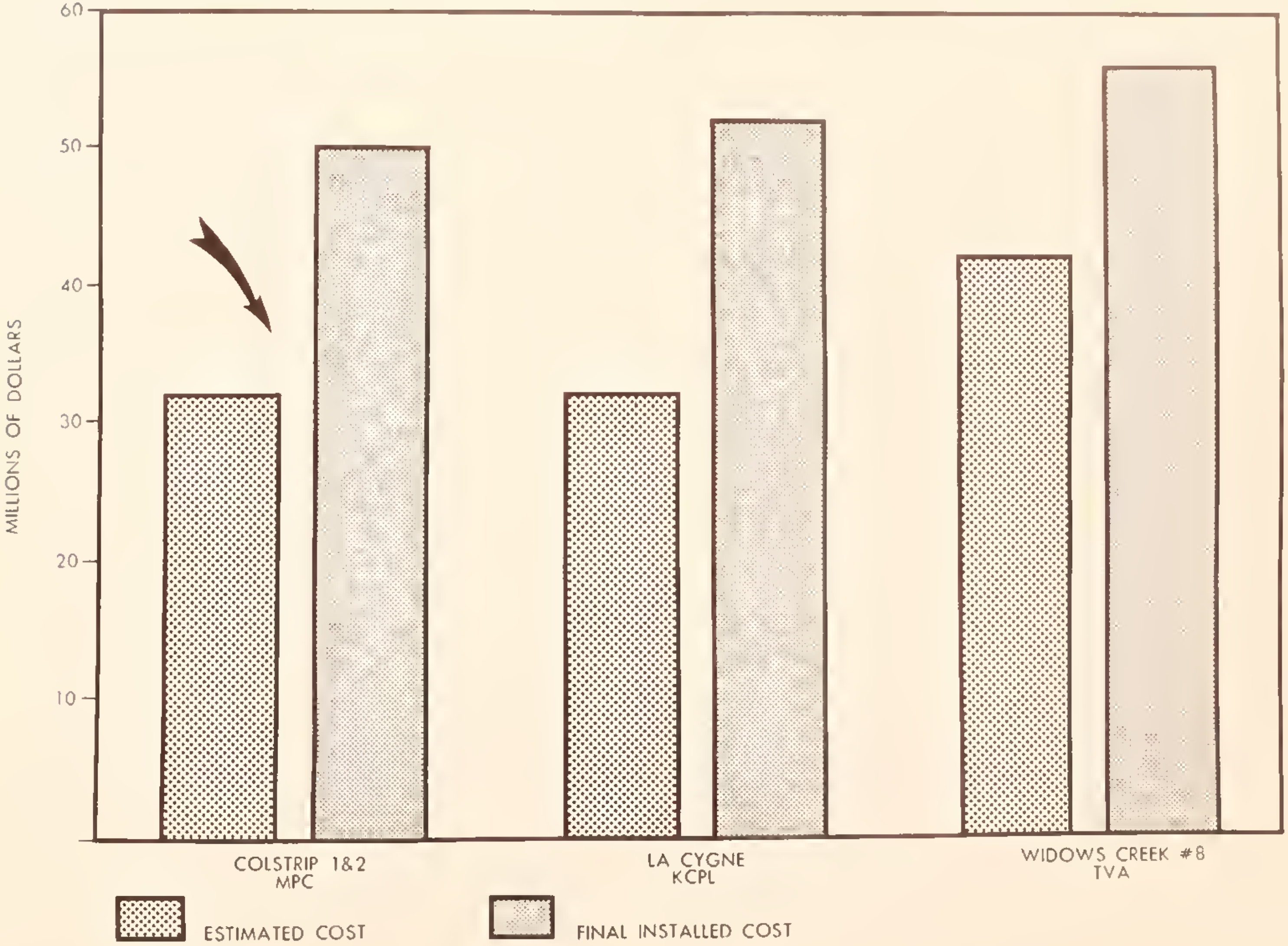
MILESTONES:

- A INCREASED SCRUBBER HEIGHT ADDED TANKS
- B CHANGED MATERIAL OF CONSTRUCTION. INCREASED L/G
- C ADDED WASH TRAYS
- D AGITATOR REVISIONS
- E ADDED WASH TRAY AUXILIARY EQUIPMENT
- F DUCT MODIFICATION
- G ADDITIONAL STARTUP ADVISOR SERVICES

MAJOR EVENTS IN SCRUBBER/CLEAN AIR/CLEAN WATER DEVELOPMENT

- SCRUBBER COST COMPARISON
  - Original Estimate VS Final Installed Cost
    - Difficult data to obtain
    - Of data obtained, Colstrip is typical

SCRUBBER COSTS: A COMPARISON
ORIGINAL ESTIMATE VS FINAL INSTALLED COST

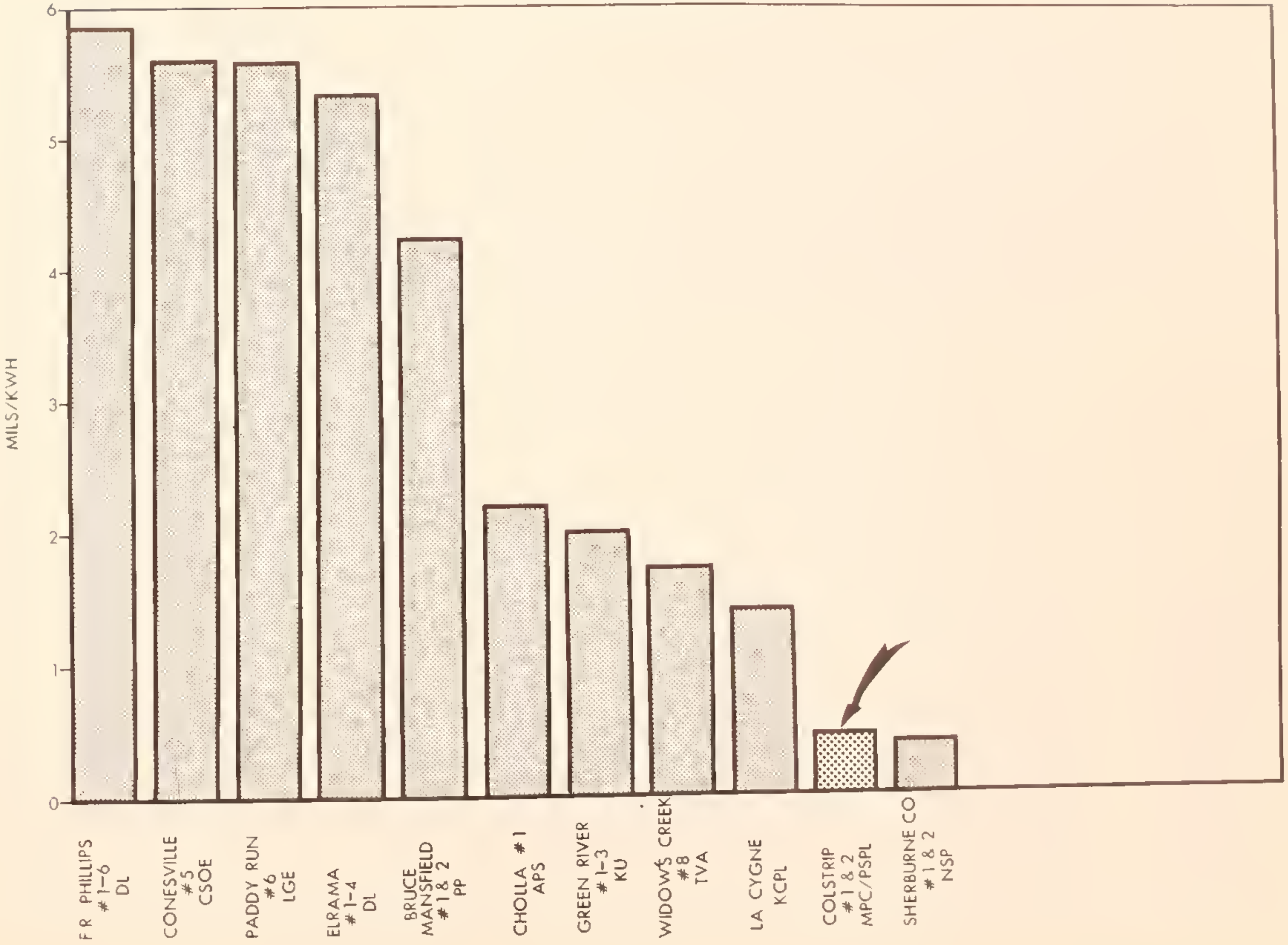


SCRUBBER OPERATING COSTS

- NEARLY LOWEST OF PLANTS USED IN COMPARISON
- COLSTRIP O&M RUNNING .45 MILS/KWH
- AVERAGE OF PLANTS COMPARED - 3.2 MILS/KWH
- AVERAGE IS 7 TIMES HIGHER THAN COLSTRIP
- SOME OTHER SCRUBBER O&M COSTS ARE 13 TIMES MORE THAN COLSTRIP
- COLSTRIP HIGHLY COST EFFECTIVE AND HIGH (BETTER THAN STANDARD) ENVIRONMENTAL EFFICIENCY

SCRUBBER OPERATING COSTS

A COMPARISON

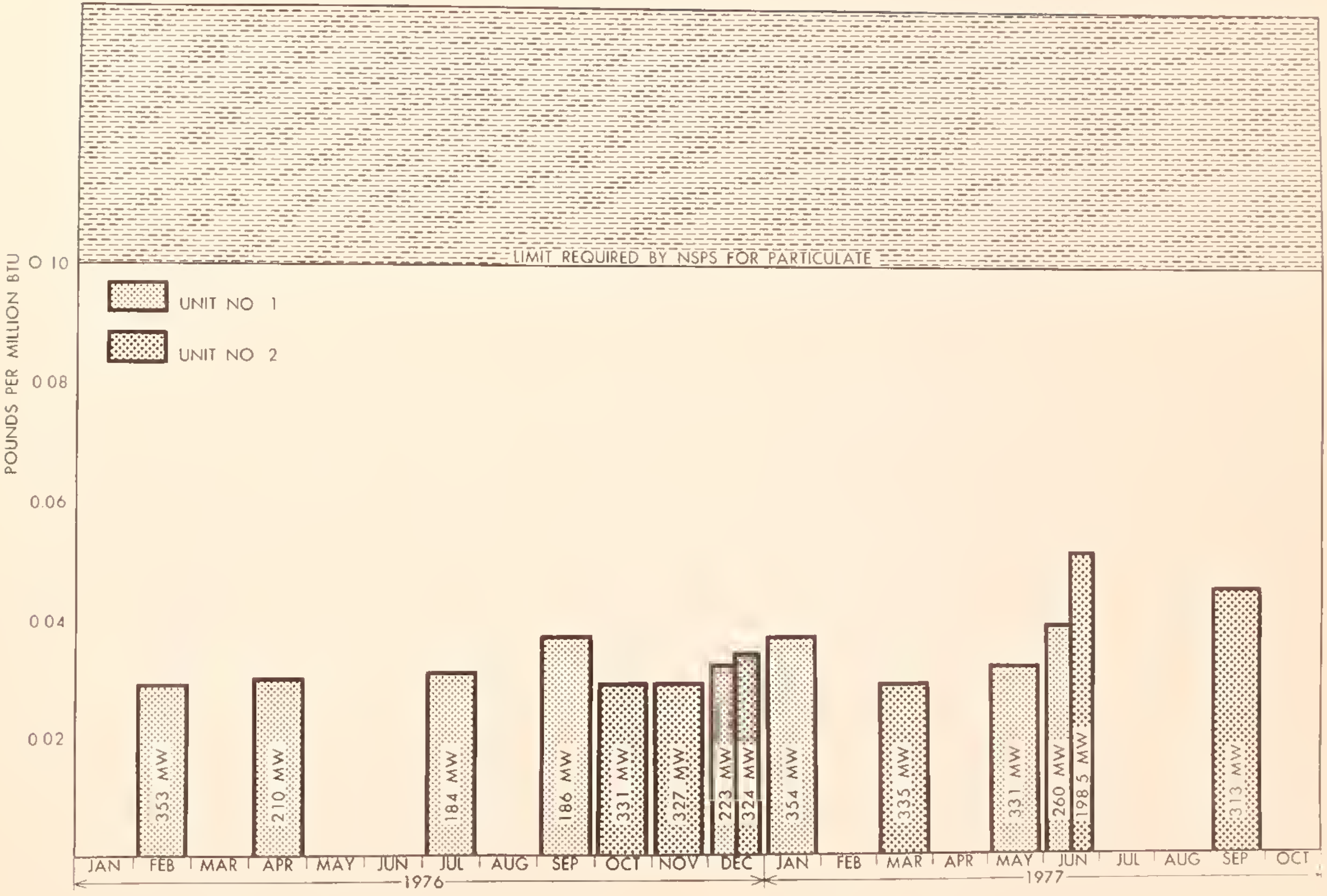


COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- TEST RESULTS - PARTICULATE
  - Total of 14 Tests Run By:
    - Regulatory Agencies
    - MPC
  - Particulate Emissions Averaging 66% Below the NSPS Requirements (.034 VS .10 Lbs/MMB)
    - (66% Better Than NSPS Requirements)

EMISSION TEST RESULTS
EPA METHOD

PARTICULATE

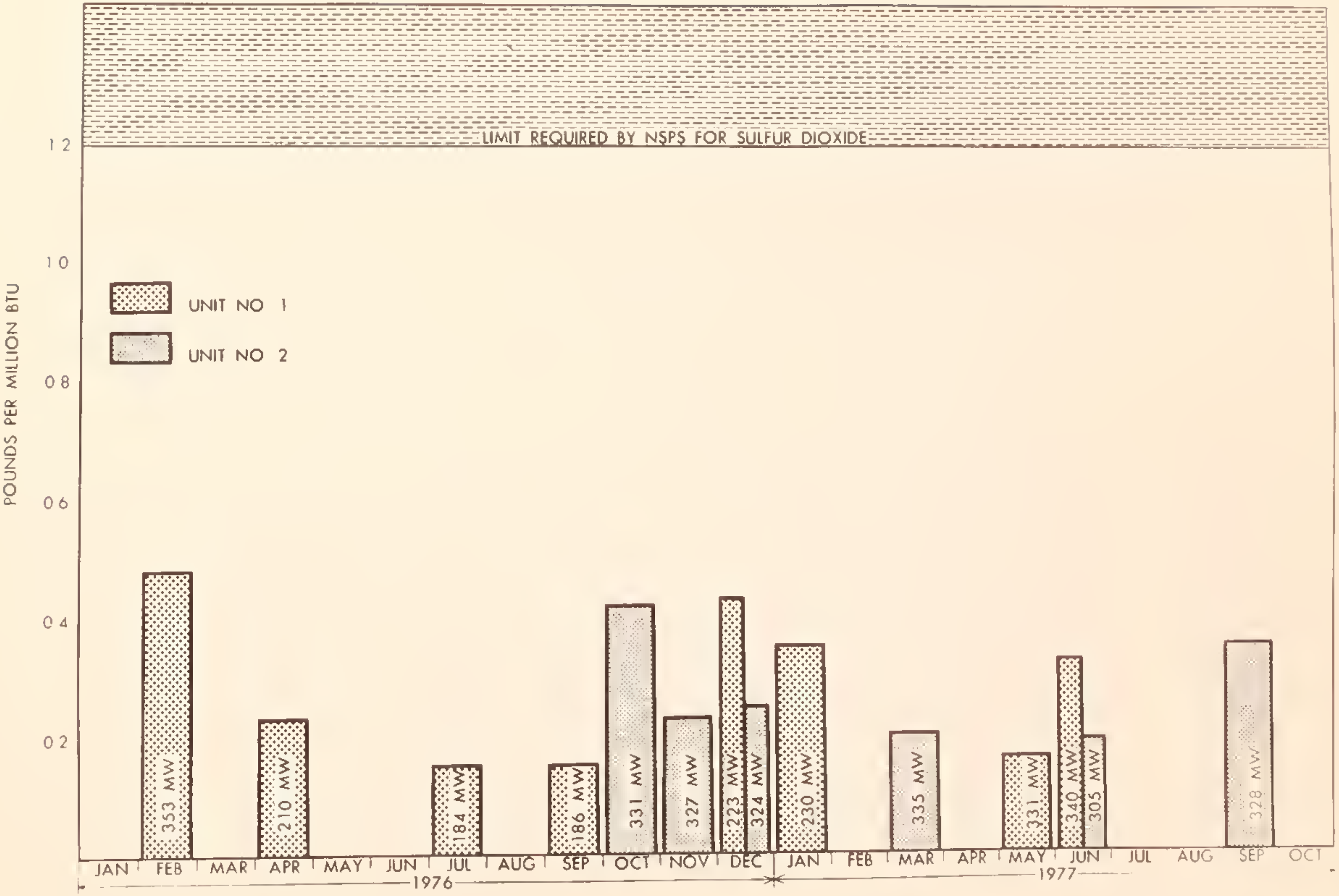


COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- TEST RESULTS - SO_2
  - Total of 14 Tests Run By:
    - Regulatory Agencies
    - MPC
  - SO_2 Emissions Average 77% Below the NSPS Requirements (.28 VS 1.2 lb/MMB)
    - (77% Better Than NSPS Requirements)

EMISSION TEST RESULTS
EPA METHOD

SULFUR DIOXIDE

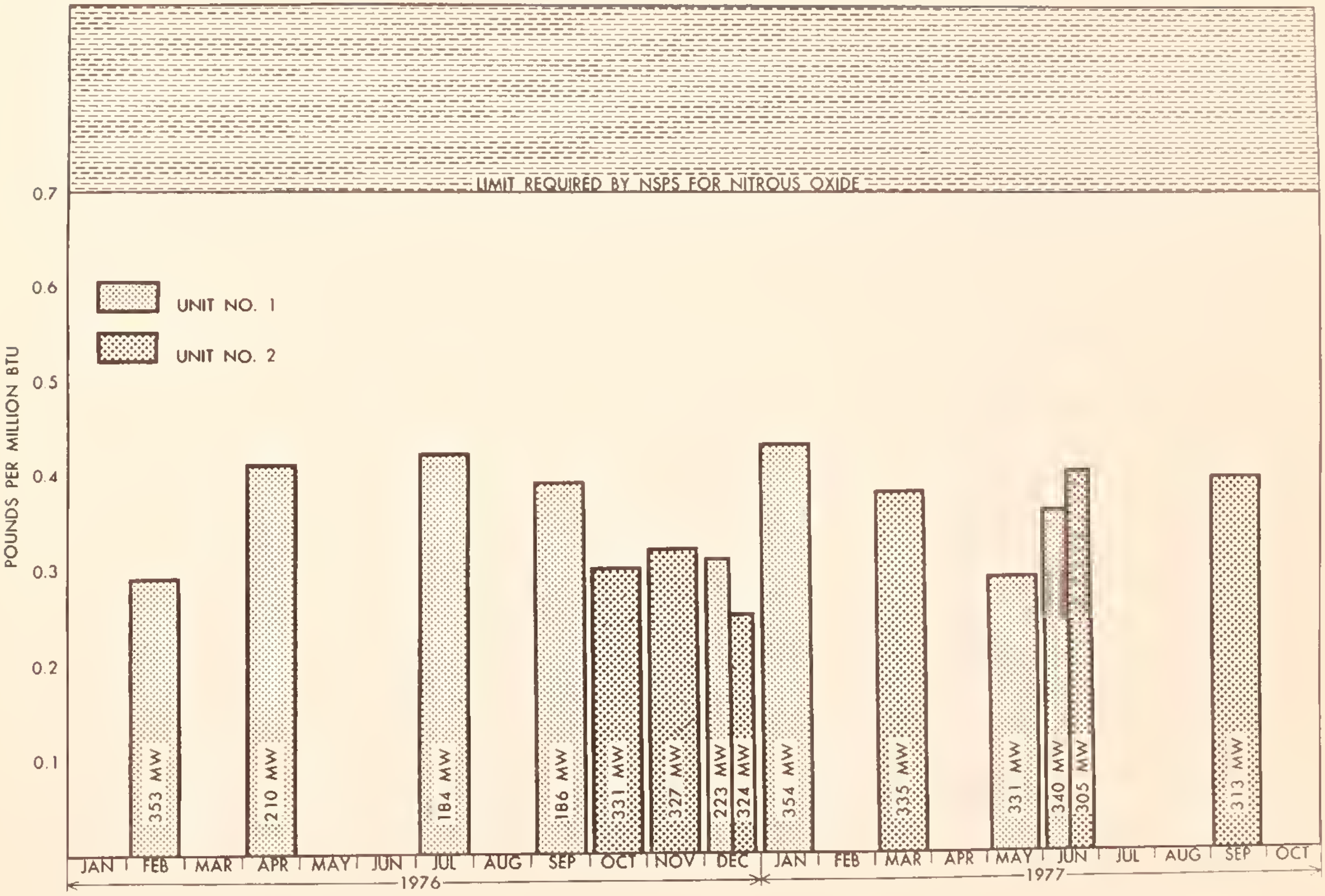


COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- TEST RESULTS - NO_x
  - Total of 14 Tests Run By:
    - Regulatory Agencies
    - MPC
  - Nitrous Oxide Emissions Averaging 50% Below the NSPS Requirements (.35 VS .7 Lbs/MMB)
    - (50% Better Than NSPS Requirements)

EMISSION TEST RESULTS
EPA METHOD

NITROUS OXIDE



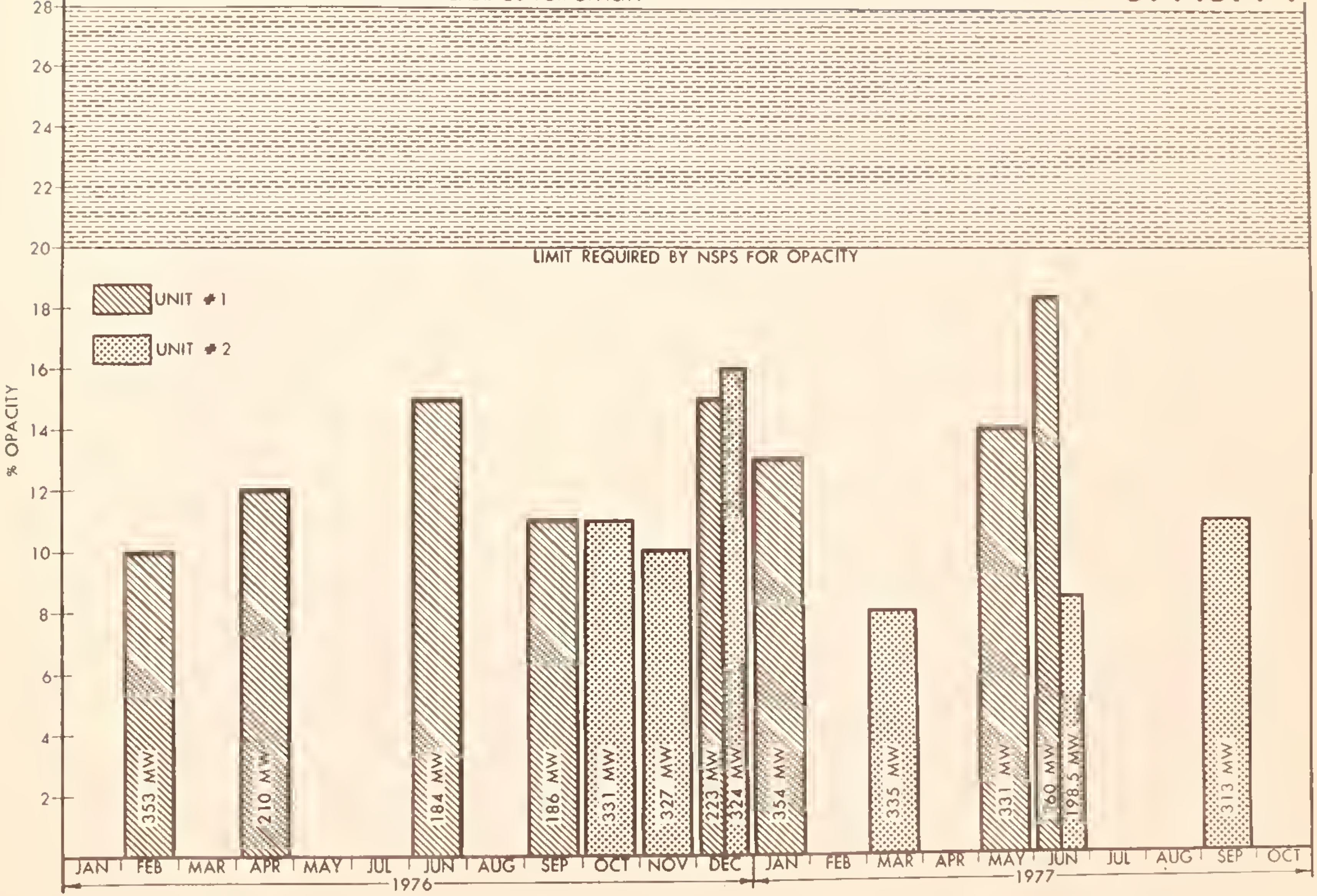
COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- TEST RESULTS - OPACITY
  - Total of 14 Tests Run By:
    - Regulatory Agencies
    - MPC
  - Opacity is Averaging 40% Below the NSPS Requirements (12% VS 20% Opacity)
    - (40% Better Than NSPS Requirements)

EMISSION TEST RESULTS

FEBRUARY AND APRIL 1976 WERE BY QUALIFIED OBSERVER (EPA METHOD 9)
ALL OTHER BY AVERAGING EDC MONITOR READINGS FOR OPACITY

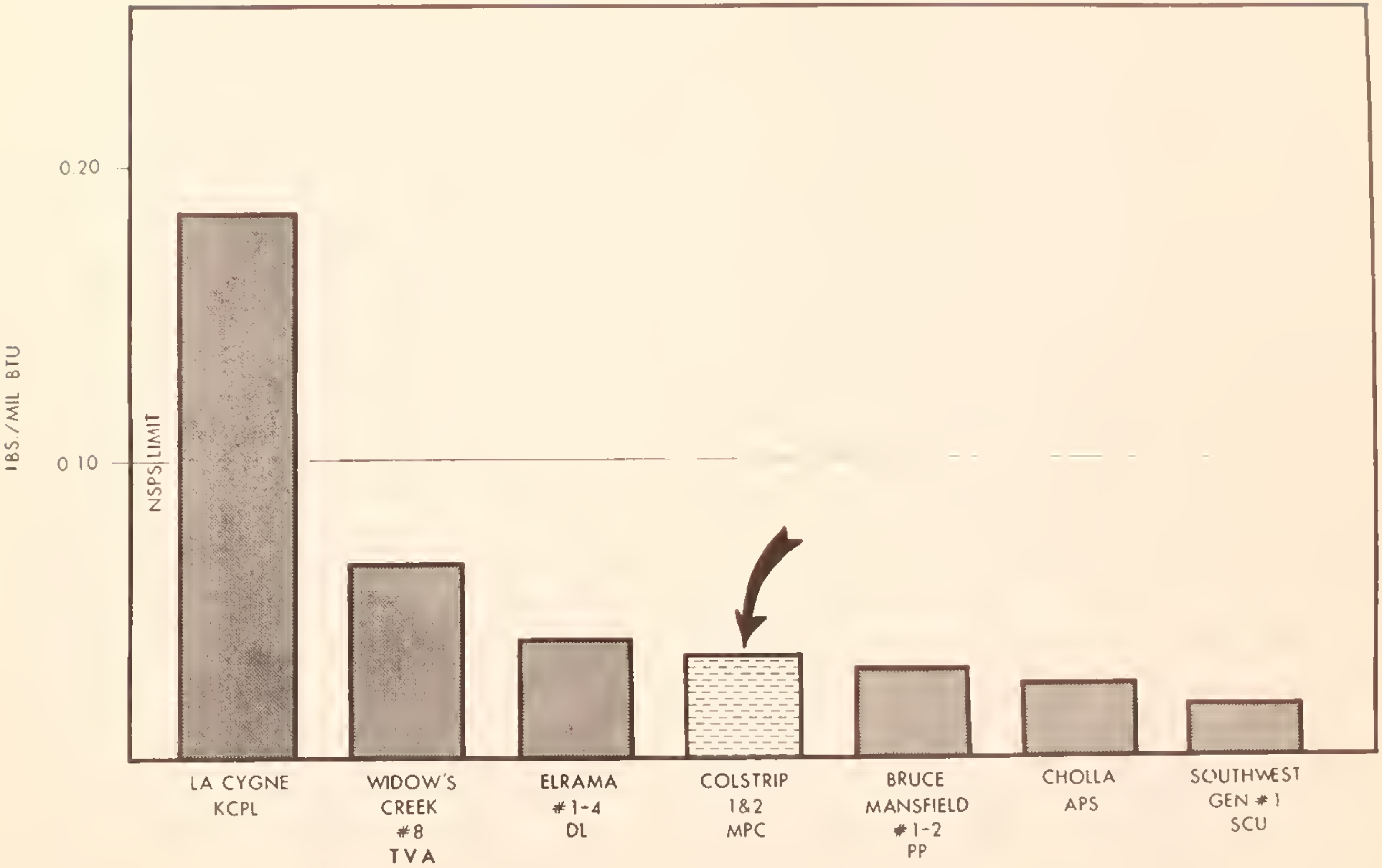
OPACITY



COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- SCRUBBER PERFORMANCE COMPARISONS - PARTICULATE EMISSIONS
  - Colstrip Average of .034 lbs/Million Btu Compares Well With Other Scrubber Plants
  - Average of Other Units is .06 lbs/Million Btu
  - Colstrip Emission is About 1/2 the Average of Others

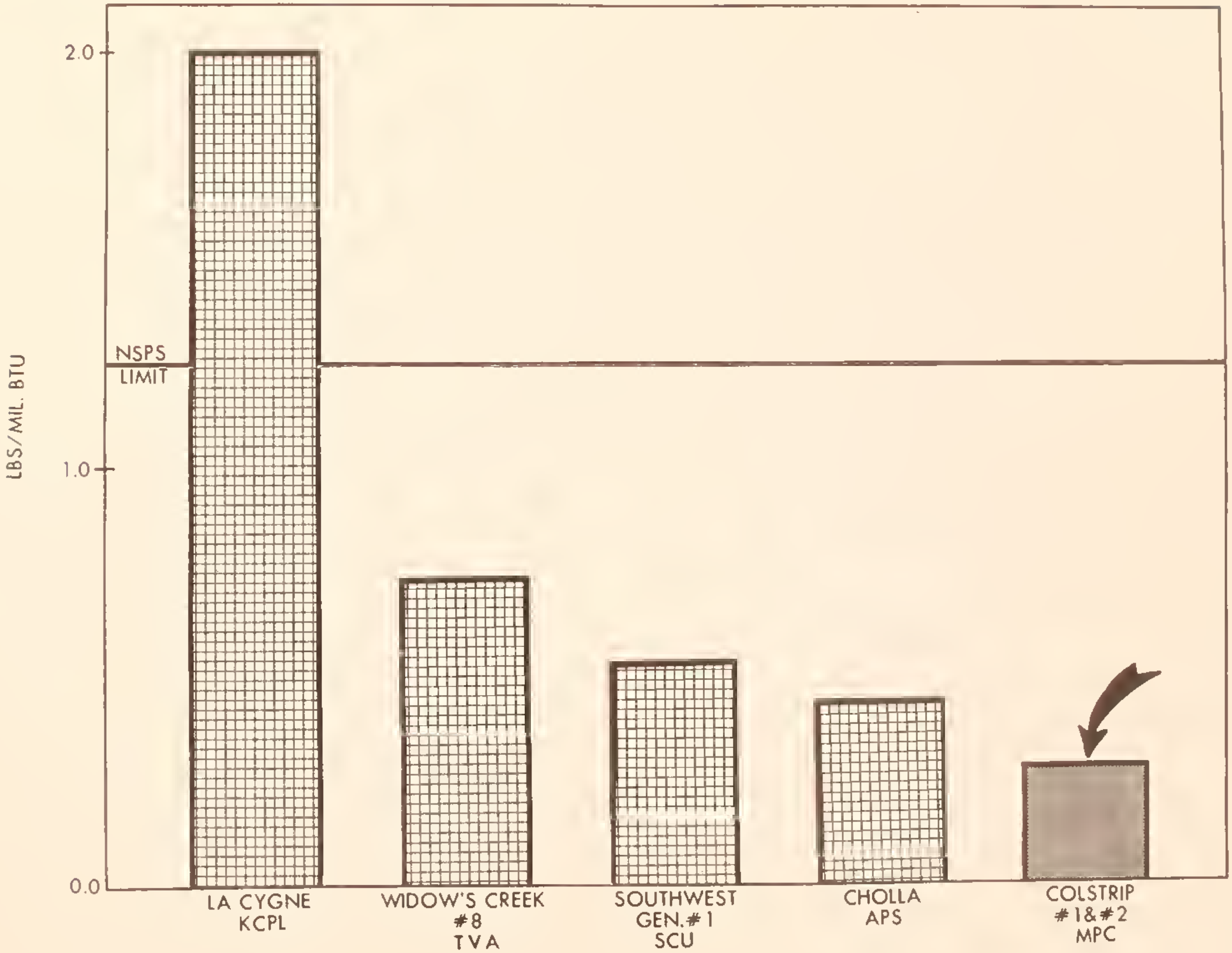
SCRUBBER PERFORMANCE COMPARISON
PARTICULATE



COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- SCRUBBER PERFORMANCE COMPARISON - SO_2 EMISSIONS
  - Colstrip Average of .28 lbs/Million Btu is Lowest When Compared With Other Scrubber Plants
  - Average of Other Units is .79 lbs/Million Btu
  - Colstrip Emission is About 1/3 the Average of Others

SCRUBBER PERFORMANCE COMPARISON – SO_2



COLSTRIP ENVIRONMENTAL EFFECTIVENESS

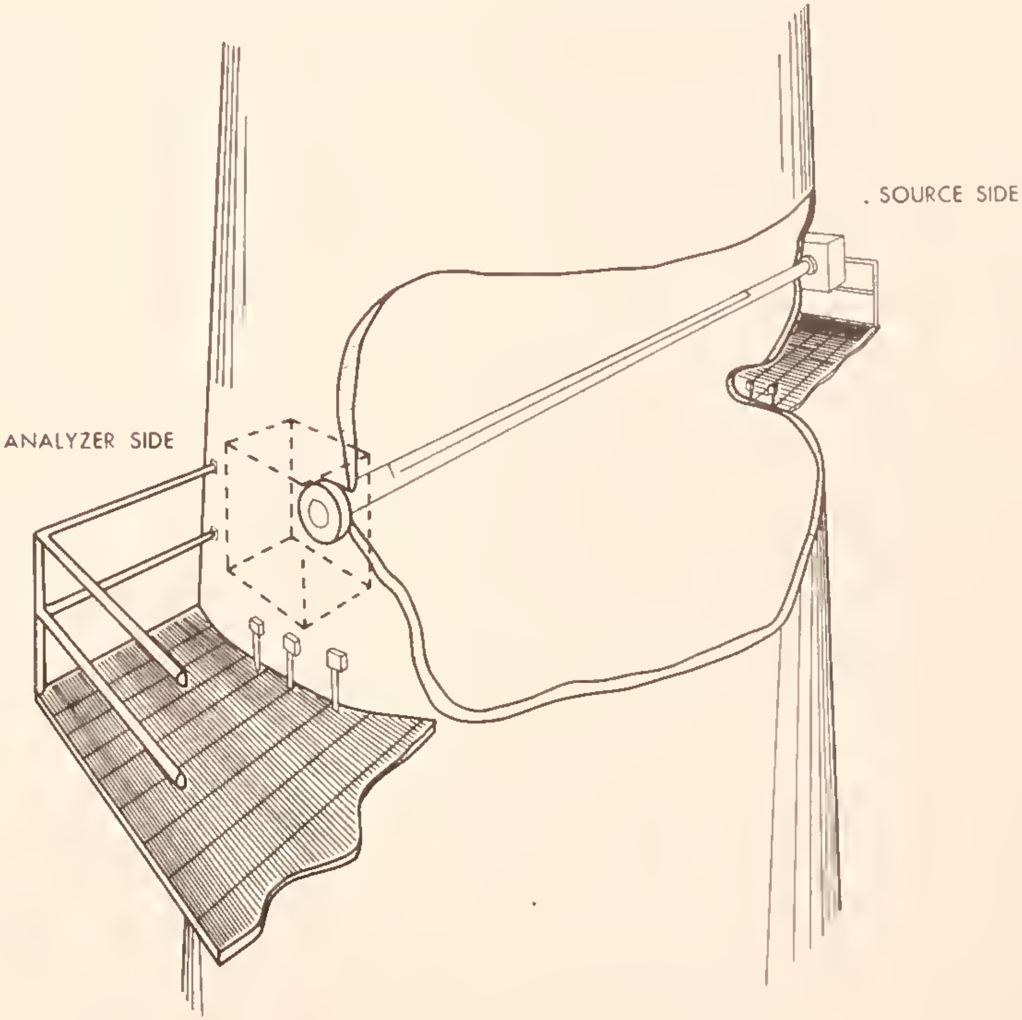
- SCRUBBER OPERATION
  - Equipment Modifications Have Been Made to Improve Availability
    - Liquid and Gas Flow Straightening Vanes Added
    - Quick Clean Pump Strainers Added
    - Isolation Valves Added
    - Flake Lining Testing and Revision

COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- SCRUBBER OPERATION
  - Do Not Have Extensive Corrosion Problems
  - Do Not Have Scaling Problems

- EMISSION MONITORS
  - Operational Characteristics
    - Manufactured by Environmental Data Corporation
    - Mounted in stack
    - Opacity - SO_2 - NO_x are monitored and
      - recorded in control room on two continuous charts
      - displayed on a digital meter
      - alarmed if limit is exceeded

ENVIRONMENTAL DATA CORPORATION
EMISSION MONITOR

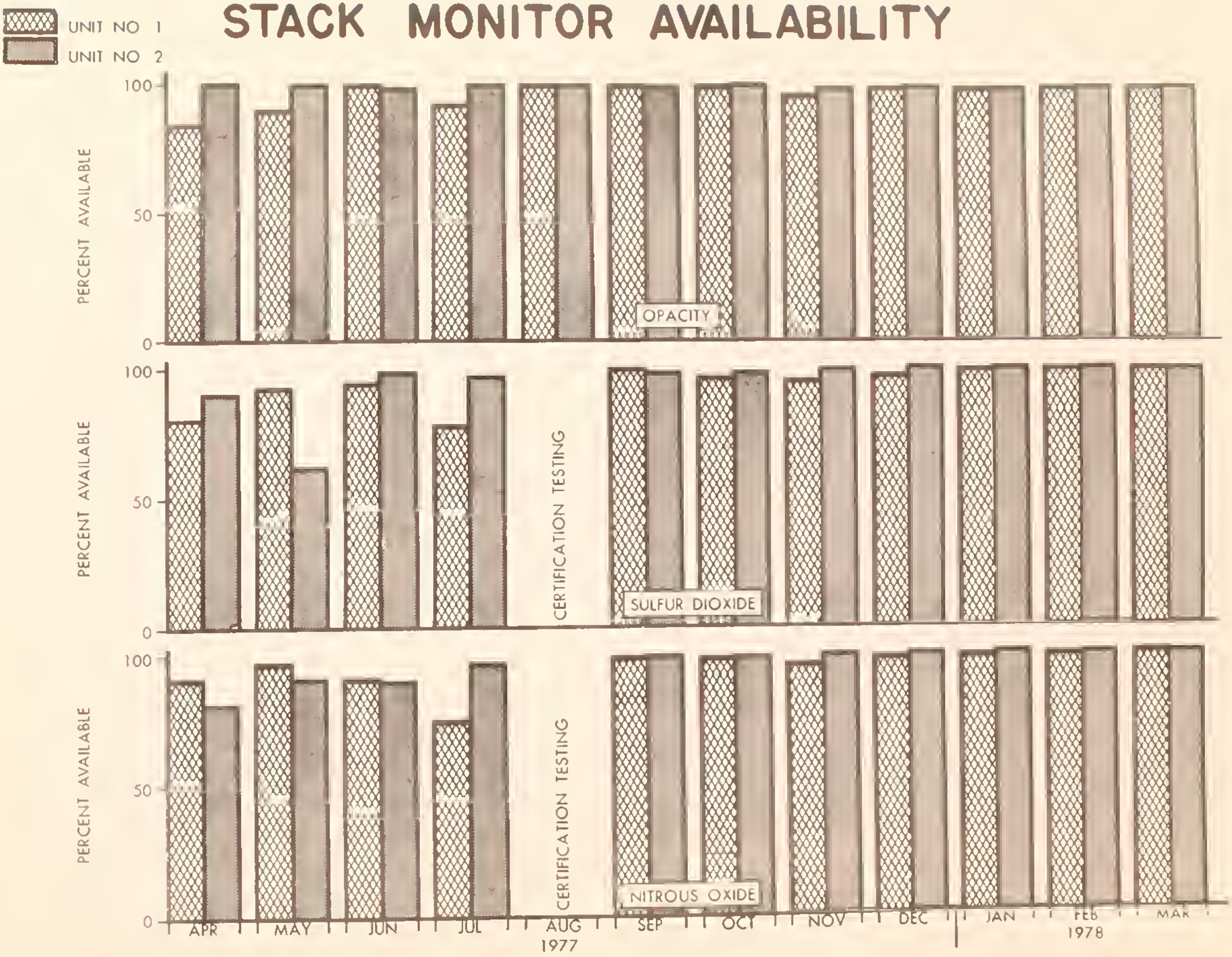


TYPICAL STACK INSTALLATION

COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- STACK MONITOR AVAILABILITY
  - Has Been On a Maturing Curve
  - Problems Have Been Cleared Up
  - All Six Channels Averaged 96% Availability Over Past 12 Months

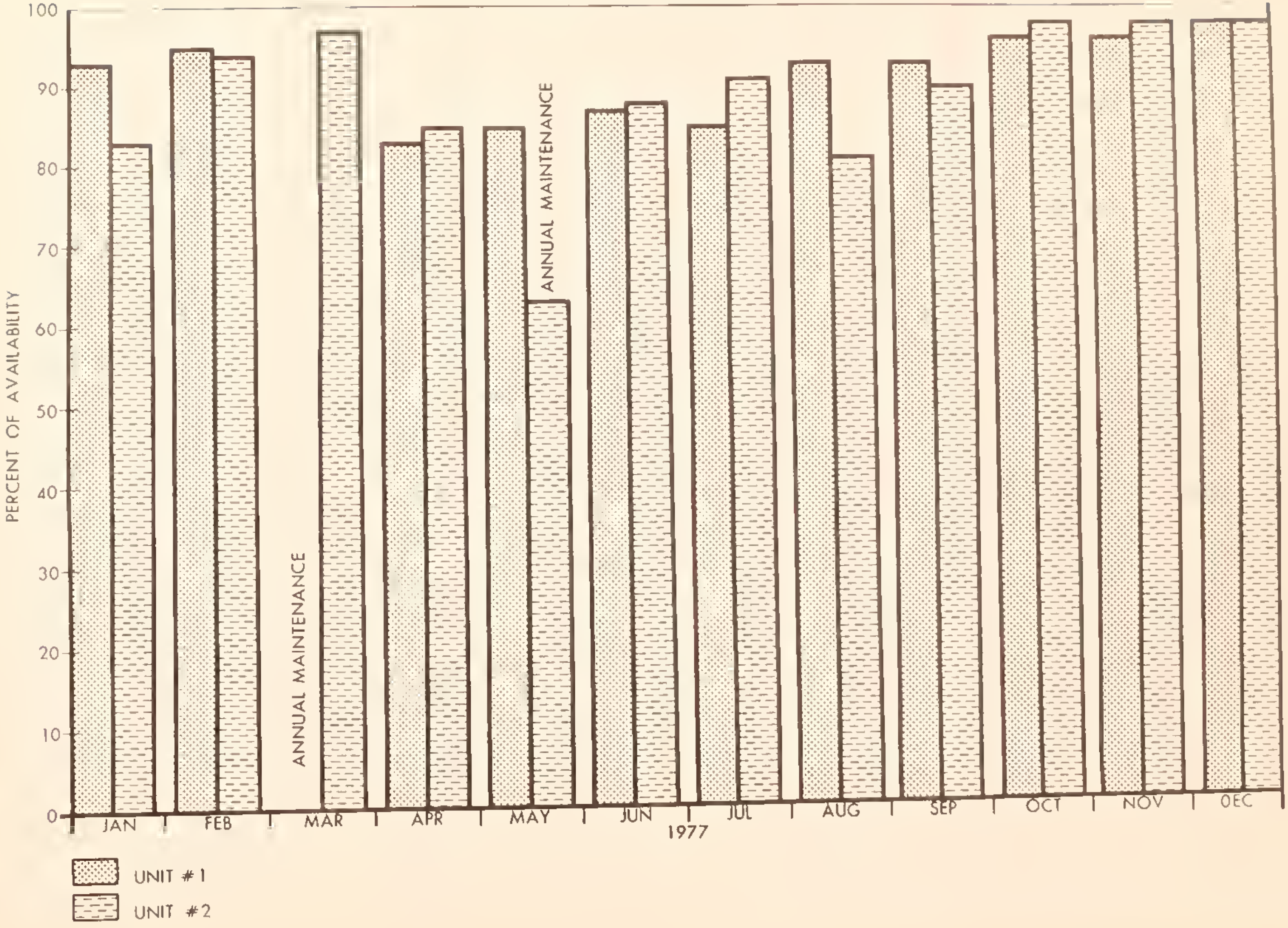
STACK MONITOR AVAILABILITY



COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- SCRUBBER AVAILABILITY
    - Continual Improvement Program Paying Off
    - Scrubber Availability Increasing
    - 1977 Scrubber Availability Averaged 90%

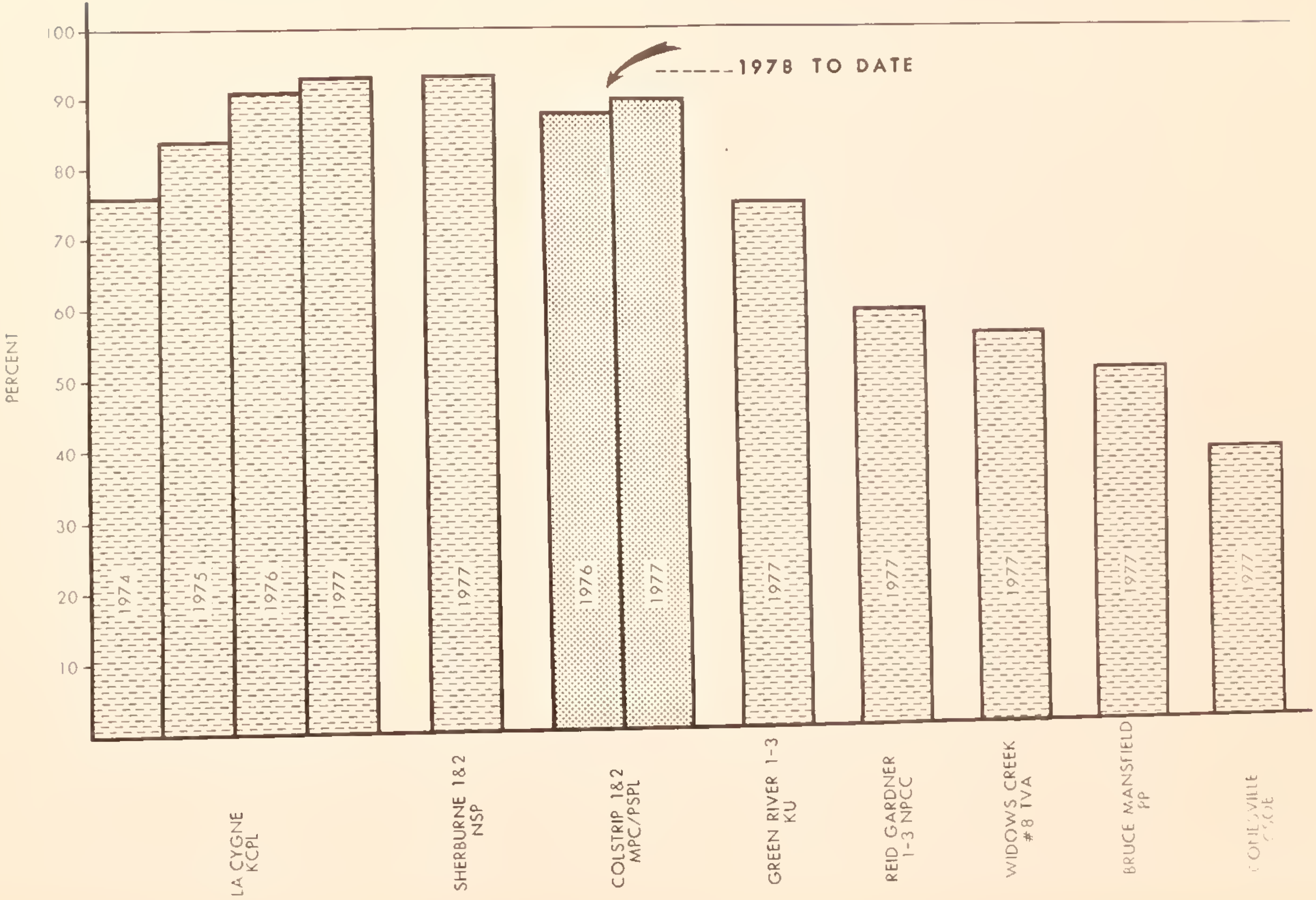
SCRUBBER AVAILABILITY
COLSTRIP UNITS 1 & 2



COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- SCRUBBER AVAILABILITY COMPARISON
  - Colstrip Scrubber Availability Nearly Highest
  - Colstrip Scrubber Availability Following Maturity Curve
    - 1976 = 88%
    - 1977 = 90%
  - Colstrip Scrubber Availability For 1978 to Date is 94%

SCRUBBER AVAILABILITY COMPARISON



COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- COLSTRIP SCRUBBER
  - Excellent SO_2 Removal
    - 77% Below NSPS Requirements
  - Excellent particulate removal
    - 66% Below NSPS Requirements
  - High Availability
    - 90%
  - Low O&M Costs

    .45 Mils/kWh - Seven Times Lower Than the Average

COLSTRIP SCRUBBERS

- ALL AT AN INSTALLED COST WHICH COMPARES FAVORABLY WITH THE INDUSTRY AND BELOW THE AVERAGE OF SIMILAR INSTALLATIONS

COLSTRIP ENVIRONMENTAL EFFECTIVENESS

- REPORTED TO THE EPA BY PACIFIC ENVIRONMENTAL SERVICES, INC.
  - "Consistently Reduced SO_2 Emissions to Less Than .5 Lbs/MM Btu"
  - "Average SO_2 Removal Efficiency is 83.5%"
  - "Scrubber Availability is 90%"
  - "Performance Unsurpassed By FGD Systems Operating at Other Plants"

REPORTED TO EPA

SUMMARY

*"A REVIEW OF THE DESIGN, PERFORMANCE AND OPERATING EXPERIENCE AT COLSTRIP UNITS #1 AND #2 AND OTHER FGD SYSTEMS OPERATING ON DOMESTIC POWER PLANTS BURNING LOW-SULFUR COAL WAS PERFORMED ACCORDING TO THE RESULTS OF 13 EMISSION TESTS AT COLSTRIP UNITS #1 AND #2, THE SCRUBBERS HAVE CONSISTENTLY REDUCED SO_2 EMISSIONS TO LESS THAN 0.5 LB/10^6 BTU. THE AVERAGE SO_2 EMISSION RATE IS 0.274 LB/10^6 BTU AND THE AVERAGE SO_2 REMOVAL EFFICIENCY IS 83.5%. A SCRUBBER SYSTEM AVAILABILITY OF APPROXIMATELY 90% HAS BEEN MAINTAINED. THIS SCRUBBER PERFORMANCE, COMBINED WITH OTHER IMPORTANT SYSTEM DESIGN FEATURES (SUCH AS A CLOSED LOOP WATER BALANCE AND USE OF ALKALINE FLY-ASH RATHER THAN PURCHASED LIME OR LIMESTONE FOR SO_2 ABSORPTION) ARE **UNSURPASSED** BY FGD SYSTEMS OPERATED AT OTHER PLANTS."

PREPARED FOR
U.S. ENVIRONMENTAL PROTECTION AGENCY
BY
PACIFIC ENVIRONMENTAL SERVICES, INC.

COLSTRIP ENVIRONMENTAL EFFECTIVENESS

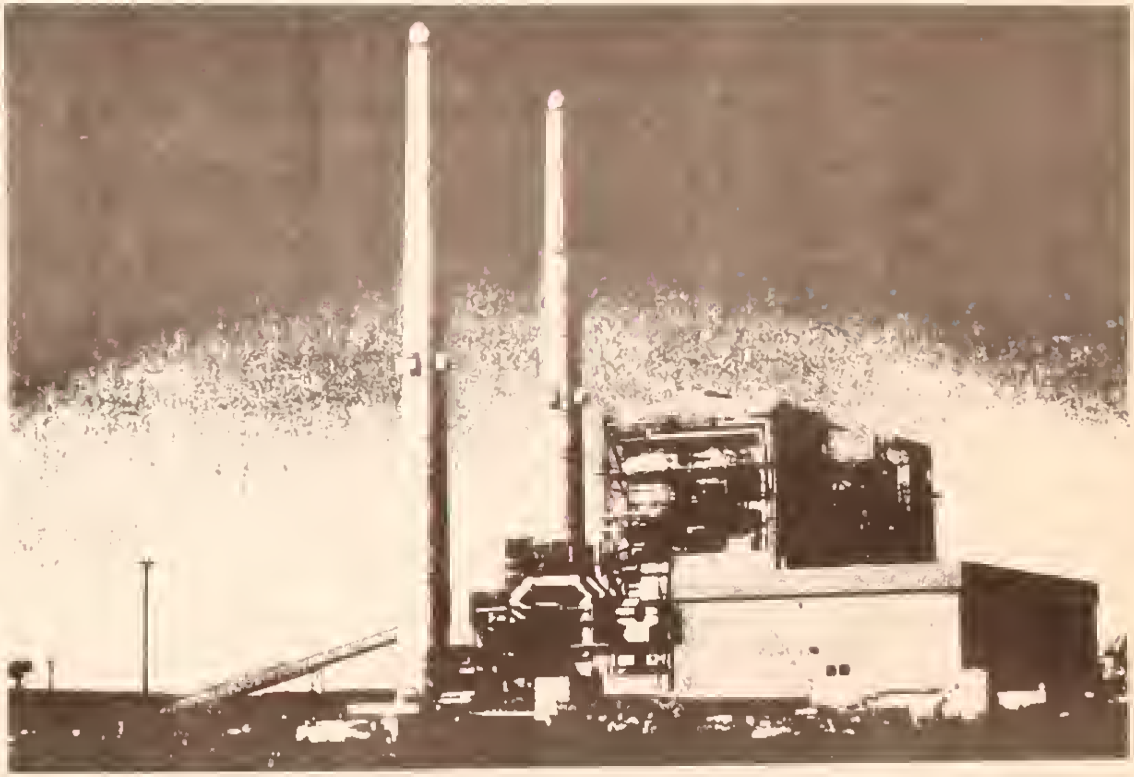
- REPORTED BY "ELECTRIC LIGHT & POWER"
  - High Degree of Particulate Control
  - Scrubber Systems Operating Within Water Balance
  - Scrubber Has Been Scale Free
  - No Corrosion Problems in Reheater
  - Test Data Shows Emissions Well Below the Guarantee and Federal Standards

Colstrip Scrubber Tops 90% Availability For One Year

The Colstrip scrubber, the first to use the reactive elements in fly ash to remove sulfur, has averaged above 90 percent availability during 1976. The system supplier reports no scrubber scaling, no reheater corrosion, no demister plugging, and opacity readings consistently below 20 percent.

No scaling, no plugging, and no corrosion have been reported at the sulfur scrubber on the Colstrip generating station

Scrubber Success Story



Sulfur scrubbers at the two 360-MW coal-fired units of Montana Power's Colstrip station have logged availabilities above 90 percent for one year of operation. For details see page 15

COLSTRIP: ENERGY, ECONOMICS, ENVIRONMENT: A SUMMARY

- COSTS
  - Plant Capital Costs of $414/kW Near the Equalized Average of $455/kW
  - Plant O&M Costs of 2.62 Mils/kWh Near the Average of 2.58 Mils/kWh
  - Scrubber Capital Costs of $69.5/kW Below Average of $77/kW
  - Scrubber O&M Costs of .45 Mils/kWh Nearly Lowest Recorded
  - Fuel Costs of 3.21 Mils/kWh Nearly Lowest in Nation

- COST SUMMARY: LEVELIZED BUSBAR COSTS IN MILS/KWH
  - Net Result of These Cost Factors:
    - Colstrip ranks #2 of 10 comparable western coal-fired stations in terms of levelized busbar costs/kWh
    - For sample of 10, average busbar costs = 21.4 mils/kWh
    - Colstrip = 17.2 mils/kWh, or 24% below average
  - Economic Portion of Objectives Has Been Achieved

COLSTRIP: ENERGY, ECONOMICS, ENVIRONMENT: A SUMMARY

- PERFORMANCE AND AVAILABILITY
  - Plant Availability Nearing EEI Average Which Included Units Without Scrubbers or Zero Effluent Systems
  - Scrubber Performance Surpassing EPA's State Regulations - and With No Corrosion or Scaling
  - Scrubber Availability Excellent -- Averaging 90% in 1977 and 94% So Far This Year -- Without Benefit of Bypass

- IN SHORT, MAJOR ENERGY, ECONOMIC, CLEAN AIR, AND CLEAN WATER OBJECTIVES HAVE BEEN ACHIEVED

NEW DIRECTIONS IN ENERGY SERIES: Part 2 -- Colstrip 1 and 2

- Discussion Summary
    - Clean Air, clean water objectives
    - Colstrip 1 and 2 accomplishment: unsurpassed clean air/water performance
    - A major achievement for the people of Montana -- and all concerned
        - Leading the nation
    - Significance for the future
        - Collectively building on a record of unsurpassed accomplishment
        - The reasoned, prudent approach
        - Collectively meeting the challenge of the future
        - The importance of the continuing dialog.

APPENDIX A

INTRODUCTORY REMARKS

J. A. McElwain

Second in the New Direction in Energy Series

Colstrip 1 and 2: Objectives, results achieved
and implications for the future

June 21, 1978

This is the second in a series of discussions on the directions in energy in Montana -- in the context of the world, national and regional energy situation.

The purpose is for all of us to conduct a meaningful dialog on important energy issues.

Energy continues to be a central issue in our times:

- Energy and society
- Energy and our economy
- Energy and the environment
- Energy and the quality of life.

COLSTRIP 1 AND 2 IN PERSPECTIVE: THE YEARS OF CHANGE -- 1968-1977

The development of Colstrip 1 and 2 can now be viewed in the perspective of the sweeping social, economic and political changes that were occurring in the United States and Montana during the years 1968 to 1977.

These, quite coincidentally, were in the years in which the need for a substantial new energy source in Montana was identified and alternatives developed.

These were also the years -- 1968, 1969 and 1970 -- during which the various alternatives were considered and the social, economic and environmental considerations that went into these decisions were reviewed.

In the years 1970 to 1975 the construction of the plant took place.

Finally, in the years 1975 to 1978, we have seen the results that have been achieved.

THE YEARS 1967 to 1975: ELEMENTS OF CHANGE

This period provides a remarkable parallel measurement of the construction of a high technology and enrivonmentally controlled power plant with major changes that were occurring in the United States from a social, political and economic point-of-view.

In terms of major changes, this period saw, among other things:

- The development of national, state and regional environmental concerns and objectives expressed in legislation.
- A new Montana State Siting Act.
- The creating of a newly constituted Public Service Commission, Department of Natural Resources and Department of Health.
- The Arab oil embargo.
- The coal severance tax.
- World, national and regional energy crisis.
- World and national inflation combined with recession and high rates of unemployment.
- A major shift in Montana and the Northwest from a virtually all hydro system to the need for major thermal generation.

These were some of the major changes that were occurring during the 1968 to 1977 period:

They have reshaped the times in which we live.

They have strongly influenced our vision of the future and what we must do to achieve it.

They clearly call for new directions in all aspects of Energy Management, including conservation, supplemental, alternative, renewable energy opportunities, planning and regulation.

They call for wide-spread understanding of the energy situation and outlook in perspective.

They call for vision, responsible statesmanlike coordinated action in which each plays his appropriate rolls to achieve the common goals and objectives.

They call for innovative solutions to difficult problems. We must look to the future with a fresh approach.

Beginning in 1968, what later became Colstrip, was in many respects one of the first coal-fired stations in the United States to go through the full cycle of the sweeping changes in environmental legislation, the economic, political and social changes that were occurring in parallel at the time.

While it may have been possible in the early stages to consider grandfathering Colstrip 1 and 2 away from the National Clean Air Standards and Clean Water Standards, as the law stood at that time, we elected in the beginning not to do so.

Instead, we elected to design and build an energy source that would perform economically and "better than" the required clean air and clean water standards.

All of this was in keeping with the objectives of the people of Montana and our objectives as citizens of Montana.

What we will be discussing today is how that development came about, what technological and economic experiences we encountered in achieving clean air and clean water goals.

We will further discuss what has been achieved by the people of Montana, in many respects leading the nation in clean air and clean water goal attainment. This is a fact in which Montana can take great pride.

We can further discuss, in the spirit of the continuing dialog, what the successful attainment of clean air and clean water objectives, as they were established in the late 60's and early

70's, coupled with a reliable and economic source of energy means for the future.

In essence, we believe that we in Montana -- primarily the people with the governmental regulations agencies and our company playing a part -- have demonstrated that we want clean air and clean water, and that working together we can achieve and have achieved it as economically as possible.

The process of achievement has been somewhat turbulent. We'll be discussing some of that turbulence today. We are hoping for and working toward less turbulence in the future.

SIGNIFICANCE OF COLSTRIP 1 and 2 FOR THE FUTURE: ONE BUILDING BLOCK

In this achievement lies one major and important building block for the future: the hope and the confidence that, working together, we can achieve a determination of some perhaps newer, clearer, practical, reasonable, definition and application of clean air standards, balanced with further economically sound and achievable air and water quality control technology.

The hope and objectives are that this balance will most nearly meet the needs and objectives of most Montanans, preserve their economic well being and the quality of life as we have come to know and appreciate it.

It is important to all of us to work toward this balanced state of affairs in a reasonable and timely fashion -- recognizing our present opportunities, technological capabilities as a nation, and our needs for the future.

We can and should collectively apply the "prudent" or "reasonable man" test to our courses of action for the future.